The Chemical Age

A Weekly Journal Devoted to Industrial & Engineering Chemistry

VOL. I. JUNE 28 1919 No. 2.

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The prepaid subscription to "The Chemical Age" is 21/- per annum for the United Kingdom, and 26/- Abroad. Cheques, P.O.O.'s, and Postal Orders should be payable to Benn Brothers, Ltd.

Editorial & General Offices—8, Bouverie Street, London, E.C.4.
Telegrams: "Allangas, Fleet, London." Telephone: City 9852 (4 lines).

Acknowledgments

OUR first duty this week is to acknowledge the cordial welcome which the first number of THE CHEMICAL AGE has received from subscribers, from leaders in science and industry, and from the Press. Our friends have all been doubly kind in their appreciation of the features of the paper which please them, and in their indulgence towards the little slips which, if not inevitable, are generally incidental to a first issue produced under conditions still far from normal. Some of the latter, it may be confessed, were a trifle vexatious. It was a little unkind, for example, of the printer to represent Professor Louis as referring to the "Hoben" process for the production of synthetic ammonia, instead of to the "Haber" process; and, accustomed as chemists are to wonderful transformations, they could hardly have been prepared for the conversion of the Chemical into the "Clinical" Industry Club. These slight departures from literary accuracy may have added unintentionally to the gaiety of our pages, but such humour will not be encouraged in future issues.

We had contemplated giving a further group of messages this week, but those already published covered the field so completely as to make this unnecessary. Their general attitude to our efforts is expressed in a communication from Dr. Percy E. Spielmann (late head of the Analytical Laboratory, Department of Explosives Supply, Ministry of Munitions), who writes:

"I look forward to THE CHEMICAL AGE acting as a powerful support in the establishment, on an ever-broadening basis, of chemical industry and chemical engineering as an essentially British development. This aim is to be achieved by the application of the very principles that the Journal has laid down for the guidance of its own progress, namely, the systematic and thorough collection and publication of chemical engineering knowledge, and the closer inter-connection between industry and pure science. Never has this co-operation been more necessary or more possible; and if industry will open its arms—and its pockets—to the scientist, the latter will continue to respond during peace with the same efficiency that he did during war. In this work of regeneration and advance THE CHEMICAL AGE should play a great part."

Industry and Labour

No one can move much among firms engaged in chemical industry without realising the prevalence of a general sense of anxiety as to the future. Without attempting completely to analyse the causes, it may be said at once that it is largely due to the uncertain attitude of labour. It is of prime importance to national prosperity that the great industrial activities developed during the war should be maintained and even extended; but the heads of industry naturally hesitate to embark on new enterprises until they have an assurance of the loyal co-operation of labour, and that is not yet forthcoming. It is a common remark that it is not worth while to set up plants for the production of chemical products in this country if similar products can be obtained from America at substantially cheaper rates, largely because American labour aims at a maximum of production, while British labour may almost be said to insist on a minimum.

The easy remedy, of course, is to exclude these foreign products, and to set up a fence round British industries. This, of course, is one of the problems that the Government must face before long. The point, however, to be emphasised very strongly is that the health of British industry cannot really be guaranteed by any artificial devices; in other words, we cannot make up for inefficiency within by any exterior contrivances. Whatever fiscal readjustments may come, the real security for British industry must always lie in its own vitality and power of production. In a word, the quality and the quantity of our output must at least equal the best of competitive nations, and they cannot do this while labour gives the least instead of the most it can. It is not the employing class alone that is affected. Labour itself stands or falls with the prosperity or failure of British industry, and the sooner the better it realises that its present

attitude may seriously affect its own future no less than that of the nation. It was not without reason, therefore, that Professor Louis declared last week that the future of this country lies in the hands of the working man. The whole-hearted co-operation which won the war is equally needed for industrial success, and one of the chief anxieties of the business man at present is whether Labour will do its part in peace as loyally as it did it in the field. When he is quite assured of that, we may reasonably expect business to go ahead.

A Fair Wage for the Chemist

Now that everyone is insisting on a larger place for science, and especially for research, in industry, it is quite natural that the student, who represents science, should ask for a standard of remuneration commensurate with the qualifications required and a fairly expensive course of education. The chemist, whether he enters industry or is engaged in research work, has not been extravagantly paid in the past. In pre-war days it was not uncommon to find a man of good academical standing drawing a salary which to-day a typist of moderate attainments cheerfully demands and generally enforces. Yet the chemist's work is of high importance to industry, and now, more than ever, it is necessary that it should be freely employed. The business man, unless he happens to be a scientific man himself, is apt to think money spent on research work so much waste, because the results cannot be guaranteed beforehand at so much per cwt. It is true that results of research cannot be foreseen; the greatest often emerge unexpectedly and where they were least expected. But generally expenditure in this field brings its own return. In any case, it seems to us important that industrial firms, whose work is closely allied with science, and especially with chemical science, should treat research as an essential part of their organisation, and regard the outlay on it as an investment. What the standard of pay should be, apart from the old process of supply and demand, depends more on the chemist than on the business man who employs him, and, with the general rise in the cost of living, the establishment of new wage values, and the increasing demand for men of high qualifications, one must expect a movement for more liberal scales of remuneration. The Institute of Chemistry at the one end has brought, and is still bringing, a wholesome influence to bear on this question, and the British Association of Chemists (which already has a membership of over a thousand) are approaching the problem from another side. It is particularly true in the employment of highly skilled minds that the best is the cheapest in the long run, and if our industries are to have the help of chemists of really high standing they must be prepared to pay a fair price.

Scientific Research at Hadfield's

On this subject of research work in industry, and the closer alliance in general of science and business, some interesting views are expressed by Sir Robert Hadfield in the interview published in this number. Sir Robert has some right to speak on the question, because at the Hadfield works at Sheffield systematic research dates from the time when he carried out his first experiments some years ago on special steels, which have since led to so many important discoveries and inventions, both as regards new products and also in providing effective control of the quality of the steel produced by the firm. Osmond said, with reference to the Hadfield invention of manganese steel, that "the Hadfield discovery and invention of manganese steel was not only the discovery of a new alloy (cumous) of great scientific value, and yet useful, but in the history of the metallurgy of iron it ranked as a discovery equal in importance to that of the effect of quenching carbon steel, and was the only one of the same order which it had been reserved for our age to make." As regards the Hadfield invention of low hysteresis steel, this material is now saving the world millions of pounds in reducing energy losses in transformers, dynamos and other electrical apparatus.

Since then the Hadfield Research Department has steadily increased both in the number of the staff specially employed for this work, and in the number and ramifications of the investigations carried out. At present the Research Department, which is under the personal direction of Sir Robert Hadfield, has a very complete equipment for the chemical, mechanical, and physical testing of steel and the materials used by the firm. The manufacturing processes are carefully watched by the Research Department, first as regards examination of raw materials, then in regard to the processes employed, and, finally, in the examination of the qualities and regularity of the steel itself. The methods of testing employed include, amongst others, chemical analysis, tensile, bending, endurance and impact tests, hardness, micrographic examination, tests for electrical conductivity, magnetic permeability and hysteresis, recalescence, firing tests of armour-piercing projectiles against armour plates, and of helmets, body-shields, etc., by attack with small arms. This list by no means covers the whole variety of the tests employed. New methods of examination and testing are constantly being investigated, so that no possible means of ensuring the highest quality of the steel is overlooked.

A feature of the research work, and an important one for its usefulness, is the help and co-operation of the managers and foremen in the works, who often add to their work on the manufacturing side investigations, such as trials of new modifications of plant or processes, or the working up of new products on a practical scale. The Research Department possesses an excellent library of metallurgical literature, comprising some 400 books dating from the fifteenth century up to the present day. The library also includes a valuable collection of cuttings from scientific and technical periodicals of all kinds, collected over a period of some fifty years.

Coal Commission Report

The Coal Commission has reported. The thirteen individuals who compose it find their convictions so irreconcilable that four separate reports are needed to accommodate the consciences of all. It is very questionable what assistance the Report can be to a Parliament already overburdened beyond endurance, for if thirteen men find it necessary to issue four reports, the prospects of agreement when a final decision has to be

arrived at among some six hundred odd legislators are not bright. It is the habit of the British Government, when faced with a difficult proposition, to appoint a Commission of Inquiry. From one point of view the expedient is helpful. It postpones the day of reckoning, and (judging from past experience) everybody concerned is so heartily sick of the particular matter by the time the report has been made, that indefinite shelving usually results. With the coal mines, or more strictly the coal miners, the position is different. If the attitude of their representatives on the Commission is any criterion (and possibly it is not) of the feelings of those they represent, the poor indefensible citizen, and industry in general, are to be exploited until such time as the miners have possessed themselves of the whole of the coal-bearing districts of the earth. What other inference can be drawn from the separate conclusions of the three miners' representatives who, in the event of State acquisition, demand that no compensation whatsoever shall be paid to the present owners? Frankly, this looks like sheer confiscation. The pleasant theory is advanced that the increased pay, which is to go into the pockets of the miners, will be counter-balanced by the increase of output; but this remains to be proved. The miners seem quite content that the industries dependent upon coal should be restricted, with the possible consequences of lack of employment, and serious detriment to our export trade. Only upon one point do the members of the Commission appear to be fully agreed, namely, that the mineral in the earth before it is won should cease to be privately owned, and should become the property of the nation. This, no doubt, is sound, and is merely an extension of the old principle of treasure trove. It is, however, only a single step towards a settlement of one of the most highly controversial questions with which the country has been faced.

The members of the chemical industries will find particular interest in the individual report of Sir Arthur Duckham, whose work in connection with coal carbonisation is well known. His suggestions as to payment by results seem to us equitable and conducive to greater output, but they may not appeal to those whom they would affect.

The Alsatian Potash Question.

The article on another page on the potash mines of Alsace, is from a French correspondent intimately familiar with the conditions out there. When the provinces of Alsace and Lorraine passed from French to German control, there is no doubt that their mineral wealth was used to the full by Germany for the development of her engineering and chemical industries, just as the textile works at Colmar and Mulhouse were used to build up Germany's textile trade. The restoration of the "lost provinces" gives back to France these valuable properties, and may be expected to develop trade between ourselves and our French allies. We understand that in Alsace at present there are large stocks of potash ready to be exported. Up to a few days ago the British authorities refused to grant a licence for their importation into this country, but we now learn that a licence has been granted for the importation of 3,000 tons. At the same time, it is stated, negotiations are proceeding respecting the importation of German potash in return for the food supplies we are sending into Germany. Some questions have already been asked in the House of Commons, and it is possible more may presently be heard about these reported negotiations. We quite recognise the practice of taking such useful products as Germany can supply in return for food provided by the Allies, but this practice must not be pursued at the expense of British agriculture, which is in need of fertilisers; nor should it take the form of preferential treatment of Germany over Allies who have loyally helped to win the war, and have suffered unspeakable injury from Germany's military operations.

The Petroleum Industry in Mexico

According to an article in a recent issue of "El Economista," the figures relating to the production of petroleum in Mexico during the years 1917 and 1918 are as follows:—

EXPORTATION OF OIL IN 1918.

	Tons.	Valued at Mex. Dols.
Through Tampico	5,271,013	100,725,081
,, Tuxpam	2,256,347	32,607,818
,, Pto. Mexico	149,554	7,171,023
,, other ports	364	53,631
Total weight	7,677,278	140,557,552

From the total amount the Government received the sum of 11,120,398 dols., which is equivalent to 7.9 per cent. But in order to show the increased yield of 1918, the corresponding figures for 1917 are given:—

EXPORTATION OF OIL IN 1917.

	Tons.	Valued at Mex. Dols.
Through Tampico	4,783,267	34,889,273
,, Tuxpam	1,427,118	12,929,579
,, Pto. Mexico	207,713	5,734,453
,, other ports	7,938	122,822
Total weight	6,426,036	53,676,127

The taxes collected by the Government (the *Board of Trade Journal* states) were 6,854,537 dols., which is equivalent to 12.8 per cent. The exportation in 1918 only exceeded that of the preceding year by 1,251,242 tons, but owing to the constant increase in value of petroleum, the companies received almost three times the sum received during 1917. From 1917 to 1918 the profit of the companies were considerably increased, and in spite of this the Government reduced the taxes from 12.8 per cent. to 7.9 per cent. in 1918.

From the total amount exported in 1918, 69.9 per cent. was crude oil, and 30.1 refined oil Of the latter, the greater part was exported by the Huasteca Petroleum Company with 1,108,942 tons; the Compania Mexicana de Petroleo "El Aguila" coming next with 557,593 tons.

Control of Seed and Nut Oils

OWING to the excessive rise in the price of certain oils and fats, and in order to limit speculative sales and purchases of raw materials, the Food Controller has made an Order restricting dealings in certain scheduled seeds, oils and fats to persons licensed by the Ministry of Food. The Order comes into operation next Monday. The articles at present scheduled are copra, cottonseed, ground nuts, palm kernels, cocoanut oil, cottonseed oil, ground nut oil, palm kernel oil, soya oil, premier jus, oleo oil, neutral lard, linseed oil, and linseed. Applications for licences should be made to the Director of Oils and Fats, New County Hall, Lambeth, S.E. 1, who has already circulated an explanatory memorandum to the trades concerned.

Shortcomings of the Water-Gas Process

By JOHN HARGER, M.Sc., Ph.D., M.Inst.M.E.

In the following article Dr. John Harger has some piquant remarks to make about the inefficiency of the water-gas process as generally conducted. Prior to the war, water gas was practically a monopoly of the gas undertakings, but owing to the demand for hydrogen for war purposes and in connection with the hardening of fats, it has rapidly come to the fore in that it forms the basis of the most effective methods of producing hydrogen. Dr. Harger, who for some time was a technical adviser to Messrs. Lever Bros., has been connected with the production of hydrogen on a large scale for industrial chemical purposes, and in a future issue he will contribute an article dealing with the progress made in the methods of producing this gas during the last year or so.

If, in practice, the manufacture of water gas was generally carried out as it is supposed to be from paper descriptions, there would be little room for improvement. In the majority of cases, however, the process is left to look after its own welfare, and is carried on in much the same way as when first introduced into this country some forty years ago. Many important suggestions for improvement have been advocated from time to time, but these have seldom been acted upon, with the result that the process is still conducted on comparatively inefficient lines. The following criticisms and suggestions are made with the object of indicating some of the directions in which higher efficiency will probably be obtained in the future.

In the first place, the air blast enters the generator cold and leaves it red hot. In blast-furnace practice there is no difficulty that has not been overcome in introducing air which has been highly heated by suitable plant using the waste gases to supply the heat; the reason why this economy has not been introduced in the water-gas process is unknown, but it is possible that the engineers who have developed and designed the plant have not had sufficient chemical knowledge to realise the importance of a hot blast. It is chiefly the iron grate of the generator which is in the way of the introduction of the hot blast, but, with the example of the modern blast furnace, it is clear how unnecessary such a grate is, and, with a suitable design of plant, there should be no difficulty in dispensing with it and using a hot blast instead of a cold one. This change would increase the economy by 10 per cent. or more, and do away with the clinkering, which is one of the worst features of the process. Moreover, with a hot blast the ash would be removed in the molten state. Again, the waste gases from the "blow," in addition to being red hot, generally contain a considerable quantity of unburnt gas, and the air blast is always worked at a uniform rate throughout the "blow."

In dealing with these considerations the following points are of importance. Special trials showing figures of 1 to 2 per cent. of unburnt gas may be neglected, for such results are not met with in actual everyday practice. In fact, 7 to 10 per cent. unburnt gas in the waste "blow" gases will be nearer the truth, and there is frequently 15 per cent.

Heat Storage

In the "blow" stage of water-gas manufacture it is immaterial whether the heat is stored in the coke *or in the coke plus some inert refractory material*, such as firebrick, but for efficiency it is essential that the heat so stored must be at high intensity, and available during the "run" to heat up the steam to 1,000° C. or more—*i.e.*, it must be available at a high temperature. It would appear that one development for greater efficiency in water-gas making in the future lies in the use of brickwork carefully designed to function as a heat store during the "blow," and as a heater during the "run" and "blow." To a certain extent the Kramer and Aarts process makes use of brickwork as a store for heat, and in consequence the efficiency of this plant, worked under perfect conditions, is about 75 per cent., against the Dellwick 65 per cent., but these figures do not allow for the fuel used for power and for steam or for stand-by losses.

To obtain greater efficiency as much heat as possible, at as high a temperature as possible, must be stored in the fuel and in brickwork regenerators. In order to do this the writer proposes to arrange for complete combustion of the "blow" gases by the addition of hot air immediately before or after leaving the fuel bed, and to store this heat at a very high temperature in the coke itself, and in a large quantity of perforated brickwork arranged in close proximity to the coke. This brickwork should be heat-insulated to reduce the amount of heat conducted and radiated away from one portion to another, because heat intensity is the factor required for success. The regenerator should be designed in several sections, each one heat-insulated from the others, the gases passed from one of these sections to another (and finally used to generate steam in a boiler if the plant is sufficiently large). The steam during the "run" and the cold air used with the "blow" should be passed through all the brickwork in the reverse order.

Ensuring Complete Combustion

It is evident that the process can be considerably improved in efficiency by working with a deep fuel-bed of 12 ft. instead of 5 ft. or 6 ft., provided the method of introducing the air blast is suitably modified—for instance, by introducing the air, preferably hot, at several different levels, somewhat after the style proposed in the original Dellwick plan; but in the new scheme, instead of having the air-supply pipe placed in the middle of the fuel, which is quite impracticable, to have the air inlets through the shell and lining at different levels. All these air holes at different levels could be worked together, or only those at one end first, and then these could be stopped, and the others further along could be brought into action as the "blow" progressed. At the same time a set of air inlets within a few inches from the exit end of the bed of fuel would be in action during the whole period of the "blow," this latter provision being to ensure the complete combustion of the blow gases.

In the process as at present conducted the steam enters the generator at a comparatively low temperature, seldom above 350° C., whilst the water-gas and excess of steam leaves at a higher temperature (800° C., or thereabouts), and the steam is forced in at a uniform rate throughout the "run." The low temperature of the entering steam could be improved upon if regenerators were used, for with such regenerators the steam would be passed through the water-gas generator at about 1,000° C. or more, passed through the coke yielding water gas, and then through a second regenerator chamber (cool), made on the same principle as already described, which would become heated up for the following air blast.

It is evident from what is known about the reaction velocities of carbon dioxide on coke that as the coke cools, the steam should be given longer contact—*i.e.*, it should be passed at a slower rate; this would, of course, yield more water gas of a better quality and save steam. Some automatic appliance for effecting this is required, and the writer believes that a special governor for the purpose has been introduced by Mr. Alwyne Meade, and also in connection with the plants employed by Messrs. Lever Bros.

Direction of the Blow

In most water-gas plants the air blast enters from below and carries away a considerable portion of small coke, which is wasted and becomes a nuisance. The waste of coke due to this cause probably amounts to 2 to 5 per cent. of the total coke used. The remedy is to substitute a downward "blow" for the more usual upward one, and this has been proposed in the Loomis generator. A downward "blow," or a horizontal one, as suggested by the writer, entails the abolition of the iron grate, and probably necessitates the removal of the ash in the molten condition, but as most of the present waste in the water-gas process can be traced, directly or indirectly, to the presence of the iron grate, progress demands this abolition.

Again, the steam is generally run in the same direction as the air blast. It must be evident that for economy of heat in the process, the steam "run" and the air "blow" must be in opposite directions, otherwise the fuel and any chequer brickwork cannot act on the regenerative principle in an efficient manner. It is claimed that running the steam in the same direction as the "blow" makes the generator temperatures more uniform, and there is not an excessive wear on one particular part of the lining. There may be something in this contention, but experience shows that the chief wear on a *good* lining of a water-gas generator is mechanical, and is caused by the tools used to remove clinker. The chief obstacle to working the "run" and "blow" in opposite directions is again the iron grate, which would get too hot and collapse or wear away quickly.

In generators as employed to-day there is too much dead space above and below the fuel. This is chiefly a matter for a slight alteration in design in pipe connections and in the generator; very often the dead space below the bars and between the top of the bed of fuel and the outlet is very excessive, apparently no attempt having been made to design the plant to give the least possible dead space. Yet for most purposes water gas is better without unnecessary nitrogen and carbon dioxide, and for certain uses 4 to 5 per cent. of nitrogen is a grave disadvantage. An existing plant can generally be put right by a few hours' work spent in altering the connections, and can then be made to yield water gas with 1 per cent. or less of nitrogen, whereas with the existing arrangements the gas may contain up to 4 or 5 per cent.

Finally, it may be mentioned that water-gas generators require to be more efficiently heat-insulated. The usual mistake made in heat insulating is to use firebrick of great thickness, say, 16 in., with 2 in. to 3½ in. of asbestos fibre packing between the firebrick and the steel shell. The better method is to use 9 in. to 12 in. of firebrick lining, then 4 in. of Kieselguhr brick, and then from 2 in. to 5 in. of Kieselguhr powder next to the shell of the generator.

Some Problems in the Oils and Fats Industries

By F. E. WESTON, B.Sc (Hons.), F.I.C.

The writer of the following article is head of the chemical department of the Polytechnic, W. He will best be remembered for his book, written in collaboration with Mr. Percival Fryer, on the subject of "Oils, Fats and Waxes." Below are discussed some of the directions in which economy could reasonably be effected in the working-up of some of the less common oils; also the necessity is emphasised for a process capable of reclaiming waste lubricants.

THE war has taught us many lessons, one of the chief of which is the necessity of being self-supporting both as regards our food supplies and the raw materials required for our manifold industries. The mere statement of this fact has almost become a platitude, and unless one can suggest a constructive policy it is waste of time to reiterate what has been so forcibly brought to our notice and made so obvious.

That this country could become self-supporting with food supplies is a matter which is open to doubt, but that it could be self-supporting in producing the raw materials used in its various industries is absolutely impossible, since many of these raw products are unobtainable here. In the case of vegetable oils and fats, a very large percentage of the raw materials could not be grown in this country owing to climatic conditions, and hence we must be dependent for them upon external sources.

If, however, we include as our source of supply the Empire as a whole, then there seems to be no obvious reason why we should not be self-supporting in every sense of the word.

There is, however, another aspect of the question beside that of supply, and that is the methods adopted for converting the raw material into the manufactured article. It is of the greatest importance for us to be assured that in any future development we shall be adopting the best methods for attaining this end, for it may safely be said that in many cases at the present time we are not doing so.

In the Oils and Fats Industries there are a number of instances of our inability to obtain the greatest value from the raw material available, and this is due in general to the want of the necessary knowledge on the part of those engaged in handling the material, and also to the antipathy displayed by manufacturers in applying new scientific principles to processes that already pay, but which, with attention, could be made still more profitable. The case of palm oil illustrates these points. There is a lamentable waste of this oil owing to its still being obtained by the old, primitive, native methods, the loss being due to two causes; firstly, the yield actually obtained is poor, and secondly, the oil very rapidly deteriorates owing to the liberation of free fatty acids, so that by the time it reaches this country it contains a considerable proportion of these acids which limit the use to which it can be put. Modern scientific methods (which were used by Germany prior to the war) are such as to give a much larger yield of oil from the fruit, the oil being of such a nature that it is much less prone to decomposition, for the simple reason that the cause of decomposition is removed before extraction. The result is that the oil is not only obtained in greater quantity, but it is of sufficient purity to enable it to be used for edible purposes. At the present moment a Belgian company is developing a palm plantation in Sumatra with a view to obtaining the oil on the latest scientific principles, the object being that of supplying European markets with a high-class product. The only reason, so far as the writer is aware, for palm oil not being extracted scientifically everywhere is that the process necessitates the extraction works being in the immediate neighbourhood of the plantations, which in some cases would entail greater expense than is commensurate with the gain resulting from the increase in quantity and quality of the oil produced.

Another cause which has limited the use of oils is the lack of the necessary scientific knowledge of the oil in question owing largely to insufficient research work having been carried out. This is particularly noticeable in the case of

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Chinese wood oil or Tung oil—a product most remarkable in several of its properties. This oil has been used for some time as a substitute for the linseed variety in the paint and varnish industries. It is a good drying oil, but does not give such a good surface as linseed oil. Moreover, owing to its peculiar properties, it does not always give the results expected. As is well known to users of this oil, it is extremely prone to undergo gelatinisation or even solidification, rendering it unusable in this state in paints or varnishes; also the change sometimes takes place in the finished article. Much research has already been done with regard to the conditions under which these changes occur, but what is required at the moment is a solution of the problem as to what the actual nature of the change is, for up to the present there has been no satisfactory explanation.

A problem that became particularly acute during the period of the war was the question of recovering from used lubricating oil a product suitable for re-use as a lubricant. At one time immense quantities of waste lubricating oil accumulated in France, being chiefly obtained from internal combustion engines and motor gear boxes, so that it became a matter of economic importance to discover some method of purifying the same. The writer was informed by an eminent authority that no English firm of oil refiners would undertake the task as they had no experience of such work, and so far as information is available at present no successful process has as yet been devised, though several attempts have been made. With the advances made in colloidal chemistry during the past few years, and with the help of other branches of physical chemistry, it should not be difficult to devise a process—capable of working on a large scale—that would solve the problem. As stated above, attempts have been made by a few workers who foresaw large financial possibilities in a solution of the problem, but unfortunately their chemical equipment was of such scanty proportions that disappointment was the result. In view of the fact that it is essential to utilise to the utmost all available material this question of the recovery of oil from waste lubricants is of great importance, and whilst it is open for any investigator to carry on small scale laboratory experiments, it is only to a very few that facilities are available for conducting tests on a working scale. Consequently, the problem is one which might most conveniently be undertaken by such a body as the Industrial Research Committee.

A Syphon for Corrosive or Poisonous Liquids

In order to start the action of a syphon it is necessary to completely fill the tubes comprising the syphon with liquid. This is usually accomplished by suction, but when the liquid is poisonous or corrosive it is, of course, impracticable to use the lungs for producing the necessary suction unless one uses a special type of apparatus, such as that illustrated in Fig. 1. This is the type usually adopted for the purpose, suction being applied at C, while B remains immersed in the liquid. If a stopcock is provided at A it becomes necessary to close the open end with the finger until the syphoning action begins. The latter procedure has the disadvantage that it is not always safe to place the finger on the end if a corrosive liquid (*e.g.*, fuming sulphuric acid) is being syphoned.

It is not always convenient to have a stopcock at A, as, for example, when the syphon is a permanent fixture used for caustic soda. In such a case the tap quickly corrodes up, and becomes a fixture owing to the action of the soda upon the glass. Another disadvantage of using this type of syphon is that it cannot be employed in cases where the liquid gives off corrosive or poisonous fumes, as, for instance, with bromine.

The apparatus shown in Fig. 2 has been designed to overcome these defects. It consists of the usual bent-glass syphon tube DE, D being immersed in the liquid, and E being at a lower level than the bottom of the vessel holding the liquid. The end E is bent at right angles, and is either connected with rubber tubing or is sealed on to the side tube of an ordinary filter pump F. It is far better to seal the tube on than to connect it with rubber tubing, for many liquids which are used with the syphon will rapidly attack rubber.

If desired, the whole of the stem of the filter pump (as indicated by the dotted lines in the diagram) may be left on, but it will usually suffice for most purposes if it is cut off about 2 inches below the bottom of the bulb, as shown.

In order to start the syphon it is only necessary to blow sharply down the injector tube G. This has the effect of exhausting the air from the tube DE, causing the liquid to flow out at H in a continuous stream.

When once the flow has started, the syphoning action goes on as usual without further blowing.

In cases where very deep vessels are to be emptied it may happen that it is not possible to blow sufficiently hard with the lungs to raise the liquid up the syphon tube. It then becomes necessary to use an ordinary rubber-bulb hand-bellows to produce the necessary pressure. It is easy, however, to raise 8 inches to 10 inches of water by the breath alone if a good filter pump is used.

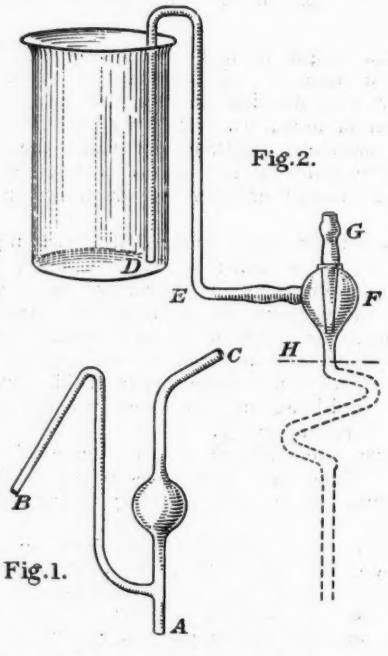


Fig.2.

Fig.1.

A useful application of the device is in connection with the Orsat gas-analysis apparatus. The absorption pipettes may be readily emptied by its means without disconnecting them or in any way altering their position.

A. R. M.

The Potash Mines of Alsace

(From a French Correspondent.)

The moment Alsace and Lorraine passed into French hands Germany's monopoly of the potash deposits of the world was broken, a monopoly which she exploited in the most arbitrary manner, and which she utilised to a considerable extent in furthering her ambitions for world domination.

The Alsatian potash deposits were only discovered by Monsieur Vogt in 1904. They occupy about eighty square miles in the regions of Muhouse, Cernay and Soultz, at a depth of from 1,500 to 3,000 feet. As the deposits, from the very first, gave indication of rivalling the famous potash mines of Saxony, the development of the Alsatian beds was only allowed to proceed slowly and cautiously. From the time of their discovery up to 1913 a total of 160 soundings had been made, but these established definitely that the Alsatian deposits equalled and even exceeded both in size and purity those of Germany. The deposits consist of two layers. The upper, which is about four feet in thickness, consists of sylvinite, which is a mixture of rock salt and chloride of potash. The lower layers have been proved to contain no less than one and a half million tons of potash.

Germany saw to it that the development of these new beds was restrained in such a manner as not to affect the price of potash drawn from her own deposits. The exploitation of the Alsatian concessions and the output of potash were, at all times, kept at a minimum. Yet competent engineers claim that the Alsatian beds could easily equal in output the German ones. In order to leave no possibilities for the development of the Alsatian beds to affect the price of potash by a sudden and immediate increase in the world supply Germany created the Potash Syndicate which every owner of potash was compelled to join. A central commission then received all the demands and orders for potash, distributed them among producers and fixed a common price, thus preventing all competition.

A total of 87 per cent. of the world's potash goes into the making of fertilisers, the remainder is used in the production of caustic potash, nitrate and chloride of potash, and other chemicals. All industries employing these suffered also from the German monopoly, and it is only by the restoration of Alsace and Lorraine to France that the monopoly has been broken. Since the Armistice, the German-owned potash properties in Alsace have been handed over to an official French Receiver, under whose direction all the mines are being worked as one whole.

Three kinds of salts are supplied by the Alsatian mines: Kainite, sylvinite (manure salts), and chloride of potash, the respective analysis of which is as follows:—

	Pure Potash.	Chloride of Potash.	Chloride of Sodium.	Calcium Sulphide.	Iron Soluble.
Kainite	12-16	19-25	60-66	2-5	10-12
Manure Salts	20-22	32-35	50-55	2-5	9-10
Chloride of Potash	50-60	80-95	4-18	1-2	-

It is hoped in France that Alsatian potash will, in future, replace the German article in England, and that not only will English agriculture profit from the competition which will result, but that the whole trade between England and France will be stimulated, for by the export of such a raw material as potash, France will be able to pay for the many manufactures produced by England which are required by France and Alsace, and which, formerly, were to a very great extent supplied by Germany.

The average annual output of the Alsatian mines is at present as follows:—

Kainite (14 per cent. K_2O), about 700,000 tons.
Manure Salts (20 to 22 per cent. K_2O), 500,000 tons.
Chloride of Potash (50 to 60 per cent. of K_2O), 80,000 tons.

National Association of Industrial Chemists

(From Our Sheffield Correspondent.)

The National Association of Industrial Chemists has now reached a membership of over 1,000. The Association is the outcome of a movement among the chemists in the Sheffield steel works, who banded themselves together last year to form an association. The objects—the economic, intellectual and social advancement of industrial chemists and metallurgists—made a very wide appeal, and it was decided to form a National Association. Local sections were immediately started in London, Birmingham, Newcastle, Glasgow, Manchester, Middlesbrough and Sheffield, and the movement received excellent support. Commencing with 100 members, it has now reached over 1,000.

At the outset of its career the Association confined its energies to the reading of papers on chemistry and allied subjects, and the encouragement of young members by awarding prizes for essays on technical subjects. Latterly the need has been felt for industrial action, and to that end application has been made to the Registrar General for the Association to be registered as a trade union. By an overwhelming majority the members approved of this action.

The latest movement is the formation of a federation, into which it is hoped to gather the British Association of Chemists, the National Union of Scientific Workers, the Electrical Power Engineers' Association, and the Society of Technical Engineers. It is hoped that the formation of this Federation will enable strong political action to be taken.

The National Association of Industrial Chemists has been recognised by the Ministry of Labour, and the Association has been invited to take part in discussions to formulate schemes under the Whitley Councils. The headquarters of the Association are now at 11, Warrington Road, Sheffield, and the Secretary and Registrar is Mr. E. J. Thackeray. In its early stages the headquarters were at the Applied Science Department of the Sheffield University, but it was felt that, in view of the activities of the Association in the direction of industrial action, independent quarters would be desirable.

Mr. A. C. J. Charlier, of London, is the President; Mr. J. Lloyd Bentley, of Darlington, the Vice-President; and Messrs. T. Ashby (Manchester), R. Blackwell (Birmingham), W. J. Davison (Darlington), W. Hargest (Hebburn-on-Tyne), T. F. Russell (Sheffield), and G. W. Thomas (Scunthorpe) form the National Executive Council.

The appointment of a General Employment Bureau Secretary has been a marked success. Positions have been obtained for more than half of those who applied, and in many districts employers have notified that they intend making use of the register in future when vacancies occur in their works.

Selenium Pigments

Selenium, an element analogous in some of its properties to sulphur, which is obtained during the smelting and refining of copper, has had but little industrial application. Mr. H. A. Gardner, of the Paint Manufacturers' Association of the United States, has, however, prepared several pigments from it—the selenites of lead and borium, for instance—which are very white and of fine grain. Their exceptionally high refractive index gives them intense opacity. Other pigments of a closely related nature may be produced from beryllium. The oxide and similar products of zirconium have a very high degree of whiteness, opacity and permanence. From titanium many compounds have been produced, and it is probable that some day they may be used as pigments where great opacity and permanence are desired.

The oil flow at Hardstoft, Derbyshire, has not appreciably increased and it has been decided to instal a powerful pump to bring the oil to the surface. At Brimington and Renishaw it is expected that oil will be struck within a very short time. At Ironville the borers are not confident that any oil will be struck, and unless conditions change this well will be abandoned.

The Chemist's Place and Function in Industry

An Interview with Sir Robert A. Hadfield, Bart., F.R.S.

Sir Robert Hadfield began the interview which he kindly granted us with a reservation. "My own line of work," he said, "is hardly in the direction of chemical engineering, though, of course, we do a great deal of metallurgical chemistry at our works, including, during the war, some 200,000 analyses per annum relating to various products." The reservation was typical of his sense of accuracy, but, if anything, it is an advantage rather than the contrary, for it enables Sir Robert, as the head of one of the greatest industrial organisations in the country, to look at things from the broader general point of view rather than from the more restricted technical standpoint.

The relation of science and industry is no new subject to Sir Robert Hadfield; he has been so intimately associated with both that it would be difficult to say which he knows best. The important point is that he knows them both as a business man, and is, therefore, exceptionally well qualified to see their relative importance and their bearing on one another in the right proportion. A Doctor of Science of Leeds University and a Doctor of Metallurgy of Sheffield University, Sir Robert is also a Fellow of the Royal and Physical Societies and of the Institute of Chemistry. He is also a member of some 130 societies and 36 councils. He has a little museum of medals and other distinctions awarded him by scientific bodies — the Bessemer gold medal for 1904, the Howard Quinquennial Prize and Premium for 1903, the George Stevenson and Telford gold medals, the John Scott and the Elliott-Cresson gold medals, and one special and two other gold medals of the Société d'Encouragement pour l'Industrie Nationale. He has served as President of the Iron and Steel Institute, President of the Faraday Society, Master Cutler of Sheffield, President of the Society of British Gas Industries, Chairman of the Ferrous Section of the Advisory Council for Scientific and Industrial Research, and as a member of the Munitions Inventions Board, of the Marine Engineering Committee of the Royal Institution, of the Senate of Sheffield University, and of the Executive Committee of the National Physical Laboratory. The number of scientific and technical institutions of which he serves on the council would make too long catalogue to be reproduced.

Sir Robert A. Hadfield, Bart., F.R.S.

It is safe to say, therefore, that not many men can speak on industrial problems with greater authority or wider experience than Sir Robert Hadfield. His strenuous life has left but little mark on him, and his capacity for work remains undiminished. He has the happy gift of doing big things very smoothly, partly because of his natural mastery of order and system. Almost literally he may be said to live in his work, for his London residence at 22, Carlton House Terrace merges into his London offices at 7, Warwick House Street, and it would be difficult, except for his week-ends in the country, to fix the dividing line between private life and business life, so closely are they allied.

Science and Industry.

"I see," said Sir Robert, glancing over the first issue of The Chemical Age, "that many of your contributors—some of them old friends of mine and high authorities on the subject—emphasise the need of a closer alliance between science and industry, and especially the importance of employing the trained chemist in industrial works. That is a view with which I am completely in sympathy and on which we have long acted in our own works, for Hadfields, Ltd., which employed during the war about 15,000 persons, have on their research and technical staff, including chemical and physical departments, about fifty-five assistants. Our chemically trained employees are divided into two classes, which may be described as class A and class B. Class B consists of those highly skilled in applied science, and who must have received training of a comparatively high order in the cognate subjects of natural science, specially in chemistry, physics, metallurgy, and mineralogy. They must possess sound knowledge of all the scientific principles involved in the control of a large industrial establishment which has to deal with the many problems presented to it, whether as regards improving old methods or the introduction of new ones. Those in class B must have had a good secondary education. These should be fairly skilled assistants of ordinary ability, with some training in chemistry, that is as regards those whose work is in the chemical laboratory, or in physics as regards those who are to deal with problems presented outside chemistry.

"At the Hadfield works at Sheffield," he continued, "we prefer to draw our supply of class A assistants from the graduates in metallurgy of our University in Sheffield, or graduates of other institutions of similar standing. The age of these men varies from twenty to twenty-four. Occasionally those drawn from secondary schools have shown special ability and have worked themselves into class A. This class of assistant is essential in the laboratory. There are twenty holding important positions in our works outside the laboratory, who have been recruited from our laboratory. Of these, seven hold the Diploma of Associate of Metallurgy of the Sheffield University, four are Bachelors of Metallurgy, one A.R.S.M., two Bachelors of Science (London), one Master of Science (Birmingham), and others have passed the intermediate examination for various degrees. One of our works directors was the first Bachelor of Metallurgy from the Sheffield University. It will therefore be seen that at the Hadfield works at Sheffield the value of a scientific training is already pretty fully recognised.

Training of Works Chemists

"I have no doubt at all as to the value of the chemical training which numbers of assistants at our works have gone through, but in some cases our experience suggests that this does not go sufficiently far in theory; that is, some of the men do not appear to be adequately trained in the chemical principles underlying their work. I do not consider that as regards ferrous metallurgy the methods of training adopted by the applied science and other departments of the University of Sheffield can very well be beaten. I do not say improved upon, because there is always room for improvement. There is no doubt that some previous knowledge of engineering is always of advantage, and especially later on in their career when the assistants have been taken from the laboratory into the works. The laboratory to us is always more or less a recruiting ground for works assistants. It is of great advantage to the assistants to be able to understand drawings. An effort is made at the University of Sheffield to include this subject as part of their training. It is also of great advantage that they should know something of the strength of materials. Purely engineering questions in themselves are dealt with by a special section of our works, who are not necessarily experts in chemistry and physics.

"I notice," Sir Robert remarked, "that several of your correspondents, including Professor Henry Louis, plead that the value of the trained chemist in industry should be more fully recognised, and state that if industrial concerns desire the services of highly trained men they ought to pay them adequate salaries. Everyone, I think, would agree that you should pay according to the ability and education of the person employed, and possibly on this point we may have something to learn from America and Germany. It is, however, matter for satisfaction that industry is recognising increasingly the services which science can render. As regards remuneration it is very difficult to fix any standard, for my experience is that firms are quite ready to pay well for the right kind of man, and I certainly agree that in order to keep British industry in the forefront we must see that in our works we have the very best scientific knowledge that can be procured."

Co-operation of Works and Laboratories

On the question of co-operation between chemical works and laboratories of educational institutions, Sir Robert remarked that in his own company's works, while they were always willing to recognise co-operation in research between the works and research institutions they regarded the following as the better plan of working. "Our view," he said, "is that if the chiefs or heads of the works directing operations are themselves well acquainted with scientific and technical matters, this co-operation, beyond existing in a general way, ought not to be necessary, though of course there are special cases where it would be advisable, but not as a rule. Research work in applied science ought to be carried on continuously in the works; pure science cannot be. By this it is not meant that in special matters useful knowledge cannot be obtained from educational institutions. On the other hand, a properly organised and modern works ought in itself to be—at any rate largely—its own research establishment, quite apart from universities, applied science departments, technical colleges or other sources. It is true that in America the Mellon Institute, which was founded to bring about this kind of co-operation, has done and is doing excellent work, but in a highly organised works of sufficient size, except in special cases and for special work, it ought to be possible, at any rate to a great extent, to meet such requirements inside and not be necessary to go outside.

"It often seems to be thought that out of say one hundred persons, it is by training possible to obtain one hundred perfect specimens in their own line of work. This is, however, not in the nature of things. There will always be the good and the bad, the perfect and the imperfect. In such a number there will be a percentage of the highest order, but such percentage must necessarily form a very small proportion of the whole. There is also the type of individual who, quite apart from education, often forges ahead from sheer ability, intuition, foresight, acumen, and good judgment. There will also be a large percentage of the 'average' individual, without which work, of course, cannot be carried on. Finally, there is a percentage of the hopeless, but speaking from personal experience, now extending over many years, I am glad to say this percentage seems to be getting smaller. Surely this can be put down to the benefits derived from the much better education which is now offered, leading as it does to greater intelligence and more interest and zest in the work of the world."

British and German Systems Compared

When the inevitable comparison was made between British and German methods of scientific and especially chemical teaching, Sir Robert at once remarked: "Some of us have been getting a little tired of hearing Germany held up as our model, and I am glad to see my friend, Professor Henry Louis, putting in a good word for English teaching. The work we have done during the war is the best answer to the suggestion that German education is superior to British. On this point your readers may be interested in the history of a manager in the Hadfield works, who was partly educated in Germany and then came over to England. The story, which I am able to give you in the manager's own words, has this interesting point—that the writer, having had experience of both British and German systems, much prefers the British. It is as follows:—

"In comparing the methods of education which obtain in England and Germany, I should say that as far as actual instruction—that is, the imparting of knowledge—goes, the German methods are superior to the English, but in the wider and higher sense of what constitutes education the English are infinitely in advance of the Germans.

"The children of the Teuton are made to work hard, far too hard, from the time of entering school say at six years of age till they leave it. There is nothing slipshod in the teaching; no advance is made in a subject until its principles are thoroughly grasped. For instance, four years' grinding in Latin grammar and syntax are considered necessary before the reading of Virgil is attempted, whereas in England this is sometimes attempted after the most superficial instruction. I have had no experience of their teaching of live languages because English was not taught at this school and we all knew French, though, of course, the instructors and the professors were all Germans. There is a very great deal of homework to be done and to this the parents, no less than the professors, attach great importance. The former generally have to help, otherwise the poor child could not possibly get through with it.

"There are much fewer examinations than in England, the great object being to make uninterrupted progress through the various classes from the 'senta' to the 'prima,' which qualifies you to enter a university.

"Certainly when the young German leaves school his brain is well stocked in knowledge, but of wisdom, initiative, self-reliance, and independence of spirit he is utterly devoid; in spite of all he knows he is badly equipped for life.

"How is this to be accounted for? In the first place by the character and the undue authority of the professors, which is often exercised in the most despotic way and in defiance of the parents' wishes. Most of the professors are ill-bred, they tyrannise over the boys, who fear but do not respect them. The pupils are not encouraged to think or act for themselves; they must perforce obey, and this unreasoning obedience has made such a strong impression on their character that when they are old enough to act for themselves they are incapable of doing so. Later on the parents decide everything for their sons as to their future career, they themselves have little to say in the matter; everything is arranged and settled for them, nothing is left to their initiative; they do not fend for themselves; they are still in leading strings and have to obey.

"But the great thing in the formation of character and general education is *play*. There are no national games such as we have, and although I think we overdo sports at school at the expense of learning, yet the educational power of play and games is very great, to say nothing of the physical development to which it gives rise. It stimulates the imagination and supplies the 'give and take' so necessary in life; provides a safety valve for overflowing energy; teaches also self-control; *esprit de corps*, and above all fairness, horror and shame of 'cheating'—in short 'honour.' All this is part of the English boy's inheritance, it is recognised as being quite as important as learning lessons. The English do not shine as teachers of 'book learning,' they are certainly not good at teaching foreign languages, and sometimes the ignorance of 'things learnt at school' displayed by young people who have quite recently left expensive schools is astounding, but those who are intelligent pick it up afterwards, and after all it is the character and not the store of knowledge that counts. The German may *know* more, the Englishman *is* more."

Two Needs of British Industry.

"On the general question of the future of British industry," Sir Robert said in conclusion, "my opinion is that the progress of industry in this country should be encouraged by not only a cheaper but a much better and more efficient patent system and by greater facilities and increased means of communication in Great Britain and within the Empire generally. No one is satisfied with British Patent Law. It is cumbrous, expensive, and inadequate. It operates, not as an encouragement to inventors and manufacturers, but as an obstacle to the successful development of new processes and new machines. The attitude of the Government towards the inventor has never been really sympathetic. Patents are granted as if they were concessions which the patentee did not quite deserve. This grudging spirit runs all through our Patent Law, and is strikingly revealed in the reluctance of the Board of Trade to extend the tenure of patents by a period equivalent to the duration of the war. In view of the intensified struggle of nations in the economic field it is imperative that the necessity of reform should be recognised and acted upon without delay. Great Britain will be handicapped, and handicapped severely, if its Patent Law is not as liberal as that of competing countries.

"May I," said Sir Robert, "just add one word. It is a word of cordial admiration of the wonderful work which our chemists have done during the war, and I wish THE CHEMICAL AGE success in any efforts it can put forth to secure that the British Chemical Industry shall maintain the great progress it has made within the past five years, and that we shall no longer depend on enemy nations to supply us with products which we can, if we like to exert ourselves, supply ourselves with very much better."

Profit-Sharing and Labour Co-partnership Schemes in the Chemical Industry

By JOHN B. C. KERSHAW, F.I.C.

ONE of the most pressing problems of the present day is that arising from the increased cost of food and other necessaries of life, and the consequent claim of labour in all countries for a larger share of the profits of industry. The military struggle which convulsed Europe for four and a-half years has given place to a struggle between capital and labour as regards their respective shares of the profits of industry; and the conflicts which are now occurring in every civilised country of the world between these two forces are not only a menace to industrial prosperity, but also to the progress of civilisation itself. Little progress towards industrial peace, in fact, has been made during the last twenty-five years; and the disputes which are continually occurring in one or other of our great industries cover wider areas and lead to serious dislocation and loss of trade.

In the United Kingdom the hopes of many are now based upon the conciliation boards which have been set up in every large industry, and it is trusted that these will supply the missing link in the industrial peace organisation. It is believed by the originators of plans such as the Whitley Councils that differences between capital and labour can all be satisfactorily settled if representatives of both sides can be induced to meet together and discuss their differences in a friendly and open manner under the surveillance of some impartial and competent third party.

It is yet too early to say how far these voluntary conciliation boards will succeed in promoting peace in the industrial world; and there are many who believe still that some form of compulsion will have to be adopted, before all disputes can be settled by such tribunals. Those who wish to see a compulsory arbitration law passed, however, forget that, in a matter of this kind, a Government cannot go in advance of, but is obliged to follow, public opinion. It has also been very rightly pointed out that there is no power in existence which can force a man to labour for less than his rightful due, nor a manufacturer to carry on his works under conditions which, in his opinion, will lead to the extinction of all profit.

Mutual Dependence

But arbitration after all presupposes disputes and conflicting claims, and is, therefore, only a palliative for a state of things which ought not to exist. To state that the true solution for the problem is not "arbitration" but "co-operation" is merely to express an opinion that has been arrived at by all students of industrial history. Everybody agrees that the ideal relationship between capital and labour is one in which the representatives of each will recognise their mutual dependence, and will agree upon a course of action in which active co-operation takes the place of passive or active hostility. But the practical application of co-operative principles to the complicated industrial organism has been attended by unforeseen difficulties, and there are those to-day who, after the experience of half a century, expect little from the attempts still being made to apply profit-sharing and co-operative principles to modern manufacturing operations. In their opinion, the only hope for an improvement in the relations between the capitalist and working classes, lies in the cultivation by the former of a more friendly and frank relationship with the Trades Unions.

The writer does not consider that these critics have done justice, either to the present developments or to the future possibilities of profit-sharing, co-partnership, or welfare schemes in so far as these are designed to promote more friendly relations between employers and the employed. This article will, therefore, be devoted chiefly to a description of some typical examples of these forms of co-operation, as practised by various firms engaged in the chemical industry in Europe and America.

Profit-sharing strictly defined, is based upon an agreement between an employer and his work-people, that the latter shall receive, in addition, to the regular wage a percentage (fixed beforehand) of the gross profits of the undertaking. Grants or bonuses which are made at the absolute discretion of the employer are not profit-sharing, therefore, in this strict definition of the term. Co-partnership is the logical extension of profit-sharing in that the worker is given facilities for investing either the whole or some portion of his share of the profits in the capital of the business or undertaking in which he is employed.

The War and Profit-Sharing

The schemes of this character which were in successful operation in Germany, France, and the United Kingdom prior to 1914 have been heavily hit by the war, for the great increases in wages has entirely altered the foundations upon which they were built-up, and in some cases the operation of the schemes

has been suspended, until the wages question is once more settled. The figures given below are drawn from two official reports published by the British Board of Trade, in 1914, supplemented from other sources of information.

A considerable number of chemical firms in Germany, America and the United Kingdom have experimented in the past with profit-sharing or welfare schemes. Although in some cases the schemes were dropped before 1914, in the majority of instances they were in operation when the War started, and they have been suspended or modified only during its continuance.

In Germany, the schemes have been directed chiefly towards securing better housing, and improved social and industrial conditions for the workers. In most of the large German chemical works, elaborate arrangements and organisations were in existence prior to 1914, for securing the comfort and convenience of the workpeople, during their working and leisure hours. It may be asked why, if the German worker was so well cared for, extreme Socialism is rampant in Germany to-day? The reply is, that not all German industries were so highly developed or organised as the chemical industry, and that the revolution in Germany was due chiefly to military and political causes; and to the failure of the military and naval forces of the Central Powers to maintain the supplies of food and raw material, required for the maintainance of their national life and industry. This failure in fact, was the chief cause of their internal loss of morale, and final collapse.

As an example of the organisation of the welfare-work at one of the larger German chemical factories, the arrangements at the works of Fried. Bayer and Co., at Leverkusen, near Cologne, may be described. This firm employed, before the war, from 5,000 to 7,000 persons, and the works covered an area of 556 acres. The housing scheme embraced the erection of 750 dwellings with small gardens, each house accomodating four families, and being let at a moderate rental. Two bachelor houses were also erected, in which unmarried men were lodged at a cost of 2½d. to 3½d. per day, and were fed at an inclusive cost of 1s. for breakfast, dinner, and supper. These are of course pre-war prices. Separate lodging was provided at a similar low cost for the women-workers, large numbers of whom were employed in the packing department of the works. Dining-rooms were provided for those who lived off the Estate, and here a substantial dinner could be obtained at a cost of 4½d.

The firm had its own private water-works, capable of supplying 13¼ million gallons per day. The sanitary arrangements were exceptionally well-planned and elaborate, many hundreds of bathrooms being distributed amongst the various departments of the works. The workpeople received medical attention free of charge.

A practical scheme of apprenticeship was provided for the sons of the workers; and a library, gymnasium, concert-hall and beer-garden were among the attractions provided.

As regards the system of profit-sharing adopted in some of the large German colour and pharmaceutial product manufactories, the firms as a rule paid their skilled chemical workmen and staff a fixed wage or salary, and a bonus depending upon the profit made in the particular department of manufacture in which they were employed. The fixed wage or salary was ridiculously small compared with the British or American pre-war standards. Chemists and engineers could be obtained, in fact, from the universities and technical schools, by the offer of salaries of £80 to £100 per annum, owing to the opportunities for advancement which existed. The bonus payments to those engaged in the manufacturing departments of the works, and the royalty payments to those engaged in the research laboratories of course supplemented these low fixed salaries; but, even then, the total salary was very low judged by British or American standards, and this accounted for the low costs of production. Whether the revolution and social upheaval in Germany will deprive her of this great advantage in the manufacture of synthetic dyes and drugs, remains to be seen; but it is obvious that in a process where skilled chemists and engineers are required by the hundred, the scale of salaries paid to the skilled staff must be the most important factor in the economic success of the industry.

At the Thann and Mulhausen Chemical Works, one of the older and smaller German independent chemical companies, employing before the war 300 workpeople, a profit-sharing scheme on the ordinary lines was introduced in 1854. This was never very successful, owing to the very small addition to the wages which resulted,—for between 1854 and 1900, only £26,000 was paid to the staff and workers, under this scheme. In the opinion of the heads of this firm, their experience proved that a profit-sharing scheme is useless, unless it adds at least 10 per cent. to the normal wages of the workers. Since 1900, therefore, a bonus system of payment has been substituted at this works. Under this system, the worker is paid the ordinary standard wage, plus a bonus depending upon the regularity of his attendance and efficiency of his work.

British and American Examples

In this country, the Castner Kellner Alkali Co., in 1908, introduced a scheme of profit-sharing into their works, and continued it for many years with success; but under the stress of war conditions and demands for higher wages, it has been dropped temporarily. The scheme was based upon the payment of a 6 per cent dividend upon the ordinary shares, the surplus profits remaining (after payment of this dividend and of all fixed charges) being divided equally between the ordinary shareholders and labour, in proportions based on their holding of ordinary shares, and the annual sum received as salary or wages, by each employee of the firm. The scheme was applied to all servants of the company who had been twelve months in their employment, and had given satisfaction to the managers. Before the war, 700 employees were benefitting under the scheme; and the bonus to labour had risen from 6 per cent. to 14 per cent. of their annual wages; the ordinary dividend having been increased from 12 per cent. in 1908, to 20 per cent. in 1912, and the bonus on wages in the latter year, thus being, 20—6—14 per cent.

In America, the only chemical firm of which details relating to its profit-sharing scheme are available is that of Samuel Cabot, manufacturing chemist, of Boston. The system adopted here is that of dividing portion of the profits each half-year among those employees who have qualified for participation; the sum paid to each being based on the aggregate amount of his weekly wages, during the previous half-year. The bonus is divided into equal parts, one of which is paid in cash, the other is deposited in a savings-bank, and is only drawn upon in case of sickness or death. The bonus has risen from 10 per cent. to 21 per cent. of the wages, since the scheme was inaugurated in 1895, and it is believed to be still in existence.

Reported Discovery of a New Alkaloid

The *Board of Trade Journal* announces that the chemists of the United States Department of Agriculture, in conjunction with the Bureau of Plant Industry, claim to have extracted a new alkaloid from the plant called in Mexico "Gobernadora," the *Covillea tridentata* of botanists, which grows in the semi-arid districts of Mexico, New Mexico, &c. The odorous characteristics and medical properties of this plant have long been known to natives and explorers, but it is only just recently that the presence of a new alkaloid has been recognised. The possibilities of this alkaloid in chemical and pharmaceutical preparations are now being ascertained.

"Gobernadora" is a shrub which grows in vast quantities in the States of Zacatecas, San Luis Potosi, Coahuila, and Durango, a little north of the Tropic of Cancer, in about the same zone as guayule is cultivated. It grows to a height of from one to one-and-a-half metres. It is estimated that a million tons of ashes, rich in potash, can be produced yearly from the green shrub now growing. It takes about one year for the plant to develop from same roots after cutting. The leaves smell of iodoform.

It is stated that in 1912 two German chemists obtained permission to make experiments on one of the haciendas situated in the States of Zacatecas and San Luis Potosi. Permission was granted on the understanding that they would furnish an exact report of their findings. The chemists made extensive experiments and disappeared without furnishing the report. Investigations indicate that after experimenting with several plants and shrubs they burned "Gobernadora" and apparently found satisfactory results in the ashes of this plant, as they departed immediately.

The Future Prospects of Chilean Nitrates

According to an article in the *Times Trade Supplement* the nitrate situation in Chile is interesting from whatever point of view it is approached, but some aspects are obscure. With regard to the future (other than immediate) of nitrate, almost everybody is an optimist. The prevailing opinion is that farming tends to become more and more scientific and intensive and that consequently more and more fertilizer will be required. Producers do not shut their eyes to the rapid development and growth of the competitors of Chilean nitrate—viz., sulphate of ammonia, cyanamide and synthetic nitrate, but they believe that the unit of nitrogen produced from their article is cheaper and a more suitable agricultural fertilizer than its rivals. Though no figures as regards cost are available from Germany, where the greatest production of synthetic nitrate has taken place, this belief in the security of the future of Chilean nitrate is based on reports received from Great Britain, the United States, and France; in all of these countries expensive war plants were put up for the production of synthetic nitrate, but few have continued in operation.

There is a further important factor in production cost of Chilean nitrate in comparison with its competitors and that is the heavy export tax levied by the Chilean Government, for it is felt that in the event of their principal industry being threatened by outside competitors the Chilean Government would reduce the tax. This tax amounts to £2 11s. 4d. per ton, and in a normal year brings in £7,000,000 to the Chilean Treasury.

In almost every case the duty far exceeds the profit made by the nitrate producer, and as it is recoverable on a unit of weight it weighs most heavily on the producers whose expenses are larger. There is at the present moment a well-defined movement, which has apparently the support of the Chilean Government, in the direction of shifting the basis of the tax from a unit basis to that of a profit basis.

If we turn from the general future of Chilean nitrate to the immediate future we encounter a more obscure and less favourable situation, concerning which the majority of producers are pessimists. The end of 1918 found the Allied and United States Governments in possession of stocks of Chilean nitrate in Europe, the United States and Chile, amounting to approximately 1,250,000 tons. As a natural result of these heavy stocks the Governments have till recently maintained their control on the nitrate market.

After the Armistice shipments of nitrate from Chile gradually decreased almost to vanishing point, and there have been no purchases made since then. The result has been that, although a large number of plants have closed down, there will be an unsold stock of nitrate on the coast on June 30 amounting to about 1½ million tons, that is to say, one million tons more than the normal stock.

The current estimated consumption of nitrate for the year July, 1919, to July, 1920, is 2,000,000 tons, or approximately the normal output of existing plants. There is thus an overload on the market of 1,000,000 tons, and remunerative prices cannot be expected until that overload is absorbed, unless there is a complete unification of all the producers' interests and the centralization of sales. Important steps in this direction have been carried out, and at the present moment about 85 per cent. of the productive power, excluding the German plants, has formed a trust to centralize sales and control production. Unfortunately for this scheme the largest individual producer—viz., the Cia de Salitres de Antofagasta—is outside the trust and the present demands of that company are irreconcilable with the ideas of the other producers. However, hard circumstances and low prices may force the dissentient into the fold. If the German plants recommence production they will influence the stock situation adversely, though it is generally considered likely that they will join the majority trust.

It is rumoured that the synthetic plants in Germany have also formed a trust, but whether this is so or not, it is probable that Germany will produce her own fertilisers irrespective of cost. This would be, temporarily, an adverse factor for Chilean nitrate; temporarily only because Germany consumed about 15 per cent. of the Chilean nitrate output previous to the war, whereas the normal annual increase in the consumption of Chilean nitrate is 5 per cent.; thus the shortage caused by the defection of German consumption would be compensated in three years.

A Chilean Nitrate Contract

A Valparaiso correspondent states that the newspapers there announce the signature of a contract for 900,000 tons of nitrate between the Chilean Government and the Corblet Compagnie of Havre. This is an exceptionally large amount, but it is not quite clear whether a price has been agreed upon or not. In nitrate circles in Chile it is stated that the sale in reality is merely a consignment arranged on advantageous terms for the buyer, and that the majority of the producers refuse to participate in the sale. Naturally the news has had a hardening effect on the Chilean exchange, which has risen to over 11d., but pending further details of the contract it is impossible to appreciate its proper importance. Since the Armistice was signed shipments of nitrate have been very small, owing chiefly to the lack of tonnage, and a number of oficinas have been closed down. The producers have formed an association of their own, but its relations with the Government are not all that might be desired. A central sales organization has again been suggested as a means of giving stability to the industry, but so far nothing has happened to suggest that the latest attempt to establish such an organization will prove more successful than previous efforts.

The Romance of High Explosives

Brunner, Mond & Co.'s War Work.

At the annual general meeting of Brunner, Mond & Co. a fuller account than it had been possible to make public before was given of the valuable work done by the Company, especially in the matter of explosives, during the war period.

During the past four years (Mr. Roscoe Brunner said) we were not allowed to tell you what work we were doing during the war, but most of you have known that we were engaged in making high explosive materials. The history of our work for the war, if it were not due to such a terrible cause, could almost be described as romantic. Quite early in the war Lord Moulton asked us to undertake the manufacture of ammonium nitrate and synthetic phenol and to purify T.N.T. All these manufactures were strange to us, and except in quite minute quantities—peace-time quantities—they had not been made in this country. Taking them in reverse order, most of the T.N.T. produced in this country and in America and Canada, which sent us large quantities, was far too impure to be used with safety. The process of purification that was adopted was invented in our laboratories and was put into operation on a large scale directly from those laboratory experiments. Phenol, the raw material of the high explosives, picric acid or lyddite, was obtained before the war from coal tar, but this was utterly inadequate to give the desired amount, and therefore its synthetic production from benzol was necessary. This process had been carried on on a manufacturing scale in France, but not in this country, and though we cannot claim the working-out of this process, our staff so improved it as to get the highest yield of any plant in the country. Ammonium nitrate was formerly made on a trifling scale by the simple process of mixing nitric acid with ammonia. Nitric acid was wanted for the production of T.N.T. and other explosives, and there was not enough of it, so that other processes had to be devised which did not need nitric acid. Quite early in the war we were asked to undertake its manufacture. It would be a source of pride and satisfaction to us to be able to tell you the whole history, with the amounts and successive steps by which those amounts were increased, but we have been told that for reasons of State we should not yet give those figures. We devoted our second largest works, Lostock, to the production of ammonium nitrate, incidentally losing a large output of soda ash. We made the ammonium nitrate by three different processes, the first comparatively simple but the other two presenting difficulties which appeared at first almost insuperable, and it was only by the heroic, devoted, and unwearying efforts of our brillliant technical men that they overcame those difficulties, with the result that we had a very large share in obtaining the result stated in public by Lord Moulton—that the supply of high explosives was always ahead of the supply of shells. In all we had nine different plants under our direct control, or under the

management of our skilled chemists, with a joint productive capacity of considerably more than 5,000 tons a week of high explosive material. We offered to undertake the original contracts at 5 per cent. above cost. We could have got more, but we thought that was enough.

The Labour Problem

As regards trade prospects there are signs that the corner may have been turned, but the revival of trade would have come much earlier had the world been convinced that there was some finality to the demands of labour. No sane man will grudge to labour its fair share of the profits of trade, but unless labour realises that there cannot be profits without proper production, and that decreased production leads to lesser profits and lessened employment, there will be no revival of trade. Coal has more than doubled in cost during the war, and the production has gone down to such a point that our export trade, upon which the prosperity of the country so largely depends, has practically disappeared, and we are warned by the Coal Controller that not only will our houses be rationed as they were last winter, but that he may have to cut down the supplies of fuel to industry, which again will lead to further unemployment. We are told that the cure for all this is to nationalise the coal mines. I fail to find that the State has done anything whatever better than it is done by private individuals. During the war the Government factories may have produced on as favourable terms as the private works, but the State had the benefit during the war of the advice and help of many of the most eminent engineers and chemists and business men, and in peace times the State would not have had the advantage of those gentlemen's services.

I can give you one instance of coal control during the war. The Coal Controller estimated that he would save 700,000,000 ton miles per annum by taking the whole of the distribution of coal into his own hands. He has not, so far as I am aware, published the result, but in our case we calculate that his intervention has led not to any saving, but to a loss of more than 2,000,000 ton miles per annum.

British Cyanides

Production Work During the War.

At the annual meeting of this company, the chairman (Mr. C. F Rowsall) made an interesting statement as to the work done during the war, and referred to important developments in view.

The past year (he said) had been a year of very great difficulty, In the first half of it all their efforts had been concentrated on increasing the production of essential chemicals, for which they were then being urgently pressed by the Government and by many of the manufacturing companies in the country. That meant, in many cases, not only the development of existing plant, but in some cases the development of practically new processes. To carry out that development without diminishing their output was a problem of the greatest difficulty, but it had been surmounted. The second period of the year had been one of great difficulty also, but of a different character. They had had to contend with the changing conditions of trade due to the signature of the Armistice. Undoubtedly, one of the first results of that was to make every one doubtful as to the future of prices, and generally as to the future of trade. Conditions such as those led to the restriction of purchase to the smallest limit; but he was glad to say that there were indications that the demand for their various products was again steadily on the increase, and they expected that that would continue to improve.

Their works manager and their sales manager had been to America on an extensive tour, with a view to acquiring information as to conditions of the chemical industry in that country. With regard to the British Potash Company, there seemed little reason to doubt the success of negotiations which were on foot to secure to the company large supplies of material. The position of the company would then be secure, and they were now satisfied that the production of muriate of potash on a large scale on competitive lines in this country would be assured.

Mr. Kenneth M. Chance (managing director), said that, during the first twelve months of the war the position of this country in regard to cyanide was very acute indeed. There were only three firms at that time manufacturing cyanide in this country, of which that company was one, and they were very hard put to it to keep the British Empire supplied. They just scraped through, after doubling their pre-war output, and afterwards the crisis became less acute, owing to large extensions having been put in by one of the other firms. They then determined to devote themselves to other chemicals which were required for the war.

Referring to the difficulties which the company experienced in the winter of 1915–16 in making carbonate of potash for optical-glass manufacture, Mr. Chance said that, in order to produce an absolutely pure article, they carried on research work in the laboratory and in the works at the same time on a different scale, putting up and taking down in the course of some three months no fewer than three large scale plants. However, they succeeded and met the full requirements of the country for carbonate of potash for optical-glass manufacture during the whole of the following spring, and since then they had carried on the manufacture of this article of very pure quality. Apart from what had been done in that direction, perhaps the most valuable work which they had done for the country during the war had been in connection with a chemical called permanganate of soda. They were approached by the anti-gas department to make that article, which had never before been produced except in the laboratory, and it was not really a part of the business of the company. The department mentioned pointed out that it was wanted for anti-gas masks, and after a good deal of persuasion they agreed to conduct experiments with a view to the production of permanganate of soda. As a result, they were successful in making it on a large scale, and he was proud to think that in this way they did very much towards rendering useless the German gas.

Coming to the most important subject of all, he said that those shareholders who stood by the company during its early troubles would remember that, at the invitation of the board, they subscribed capital for putting up new works for the purpose of trying out their method of fixing atmospheric nitrogen. Those works were put to another use during the war and they could not carry on their experiments on a big scale because they were too busy on other things; but they had now got everything ready, and had obtained the additional advice of Sir Arthur Duckham, which should be of the utmost value to them for this purpose. They had got their furnaces ready and were simply waiting for the peace holiday week to be over before re-starting these experiments. They had the same staff that carried them up to the point originally reached; and they were going back to what had, after all, been the life work of those of them who had spent seven years already on this particular problem. He had been told that it was impossible and perhaps it was; but, personally, he was absolutely convinced that not only was it possible, but that there was a huge new development awaiting anybody who brought out the process on which they were working. Shareholders knew how near those working on the process had been to success, and that the difficulty which had hitherto prevented real success was one on which Sir Arthur Duckham was perhaps the greatest expert in the world—certainly in this country. That gentleman said that as far as that point was concerned, he was certain he could get through. They had all their plans ready for restarting after the first week in August, and although it might not be next year, he hoped that in the following year they would be able to come to the shareholders and say that after all those years they had succeeded.

Zinc Corporation and Trade Outlook

At the annual meeting of the Zinc Corporation, Ltd., the outlook for metals and trade generally was very fully discussed by the chairman (Mr. F. A. Govett).

Our future profits (he said) will depend more on the production of lead concentrates. This, however, has no immediate bearing; indeed, the whole aspect of the problem may be changed by the Elmore or by the Ganelin process. The business of the mine has been conducted during the year with the greatest difficulty, with continual strikes and rumours of strikes, shortage of coal and shortage of labour, and with great inefficiency of labour, for the best men have gone, and the inefficient residue are not inclined to work too hard. I regret to say, however, we are still shut down, and as our recent cost of production of lead concentrates is only covered by a price for lead of about £19 10s. f.o.b. Port Pirie, and recent labour demands are just extravagant, the position is not too happy.

As regards the progress in metallurgical development, the Tasmanian Electrolytic Co. has justified its claim, is producing electrolytic zinc, and contemplates an increase in plant to 100 tons a day. Of the other three processes, a large company, with £200,000 working capital, has been formed for the Elmore process. No actual commercial demonstration has yet been made, nor in eitherof the other two, but the work done in the trial Elmore plant is regarded as being quite sufficient proof of the value of the process. We have acquired a two-fifths interest in the Australian rights of this patent, and we have arranged to put up a trial plant at our works on a commercial scale, while the Amalgamated Zinc are doing the same with the Ganelin process, in which we also have a share. I make no forecast as to which is probable. But the gain to be effected is considerable in either case.

At the present moment the outlook is not too good, for the stocks of base metals existing in the world are very large, while actual consumption is small. Fortunately, so far as our zinc concentrates are concerned, the position for us is safe, as our contract with the Government leaves us only a comparatively small amount of concentrates to sell, and it looks as if that surplus may be sold, for it can be sold by Government to France or Belgium, in which countries the smelters want raw material. This seems to me, however, to depend rather on that same condition—namely, the amount of their metal production they may be able to sell, which at present appears to be the factor, consideration of which is universally omitted. In all discussion of our present financial and industrial conditions, no matter in what industry, the cry is that increased production is the only method of salvation, and the question of what it may be possible to sell is never raised. Last year the indications were that metal stocks would be very small, but the need of using every ship for the transport of American troops made lead shipments impossible from Australia, with the result that the Government demand for American lead at prices far higher than we were charging enormously stimulated production, and the fact is that existing stocks are now very large, though probably not greater than the need for metals, always supposing that the price admits of the demand being satisfied and the expenditure being permitted by the financial position of the world.

During the war we placed the whole of our production generously and absolutely at the service of the British Government. We never attempted or desired to exact the open market price, and the whole of our operations were conducted always with the single object of patriotic assistance in every possible way. This was fully recognised, for up to a point the handling of the lead position by the Ministry of Munitions reciprocally was admirable, and we had nothing but respect for the Lead Controller. I regret to say that recently we have been faced with quite another attitude, under an entirely different class of Government control. Australia, who entered the war in August, 1914, is left to struggle as best she may to keep her industries alive and compete for British trade with America, who came in in 1917, with others who did not come in at all, and with the Imperial Government itself, with its accumulated stocks. We refused to take the advantage of the profiteering prices exacted by our foreign rivals. To under-estimate the difficulties with which we have been and still are faced would not be wise, but, great as they are and needlessly increased, I do not doubt our ability eventually to overcome them, subject always to reasonable industrial quietude.

Unless European industry be re-established on something like normal lines, we, who depend mainly on European consumption, cannot expect to sell our production, and in this direction the danger has been aggravated by the unemployment policy of the Government, which strikes at the foundations of all industrial life. It is bad enough to have to pay people and keep them working for their pay, if what they produce can find no market, which may, indeed, at times be necessary, but it is fatuously and hopelessly wrong to pay a man for doing nothing, which is what they have been doing, an absolute discouragement to the habit of work, which is the bedrock basis of all commercial existence.

The proper policy for the Government is, plainly, to keep British industry and labour—in this case, that is, our Australian industry and labour—prosperously employed, if possible by natural means; if not, then by tariff or by bounty within reasonable limits. At the same time, the Government must hold off the market their accumulated stocks until such a time as they can sell, and then only as demand exceeds normal current production.

Chemistry and Modern Warfare

At the last meeting of the Newcastle Section of the National Association of Industrial Chemists, Mr. Henry W. Keenant read a paper on "Chemistry and Warfare."

Mr. Keenan said that modern warfare had relied upon chemistry for frightfulness, and appealed to chemistry for protection against the frightfulness created by chemistry. Chemistry as applied to warfare had been divided into two classes—offensive action and defensive action. Every item existing in the offensive class of warfare had a counterpart in defensive warfare. The high explosive shell was the result of research by several chemists. The simple schedule of the first gunpowder (pot. nitrate, 75 per cent.; S., 10 per cent.; charcoal, 15 per cent.), heralded the advent of the H.E. shell as it was known to-day. Although many centuries stood between the first discovery and the present form, it was indisputable that the early simple form was the origin of explosives for warfare. Gunpowder in its earliest form was introduced to Europe by Schwarz, and the use of detonators was introduced later by Howard. The detonators provided a class of their own, and, for the most part, consisted of fulminates of some metal—mercury fulminate being the most common. Towards 1824 the artillery received the attention of Braconnot, who worked upon the possibilities of nitrocellulose; but five years elapsed before he had any measure of success. Its great asset as a projectile explosive lay in its property of a slow explosive force. The way was paved for Nobel by men like Lussac, Violette and Braconnot. In 1849 Sobrero found that, by treating glycerin with dilute nitric acid he obtained nitroglycerine. Common cordite as known to-day, was formed of nitroglycerine and nitrocellulose. It was by, working on Sobrero's discovery that Nobel produced the best-known explosive—dynamite.

The only method devised of reducing the offensive action of high explosive shells was to build concrete and metal shelters and there again chemistry was called in to play a part. Another way in which the chemist had succeeded in lessening the offensive action of high explosives was to produce a shell which gave off sufficient gas to interfere with—and, therefore, decrease—the work of the gunners themselves.

Gas Warfare

Mr. Keenan dealt at length with the development of gas warfare. The German chemists, he considered, had signed their own death warrants when they sent over their first wave of chlorine gas. The British chemists had retaliated by drawing up a schedule in which phosgene, chlorine and arsenic trichloride formed the chief constituents. He described the work of the "Special Brigade, R.E." during the war. The Brigade consisted of a body of men with chemical knowledge dealing with the offensive and defensive measures of chemical warfare. One of the great achievements of the secret section of the army was the discharge of 10,000 gas-drum projectiles simultaneously. The charges were fired by electricity and the contents penetrated gas masks which were properly adjusted in every respect. It was due to the chemists that the British small box respirator was so efficient. The defensive section of the secret section confined their operations to making dug-outs and respirators gas-proof.

Mr. Keenan said that the Royal Air Force owed a debt to chemistry for the success of the experiments in producing a composition for making areoplane fabric taut under great stresses. He hoped the State would recognise the debt of gratitude it owed to the chemist during the war by raising the status of the chemist. The chemistry which had proved so efficient in the war could be directed to the work of healing the nation in time of peace; and he hoped that full opportunities would be afforded by the Government for the development of the chemist's work in industry.

In addition to the stoppage at the Cape Copper Works, Pritchard's Chemical Works, Crumlyn Burrows, South Wales, have been idle a month, some 140 men being affected. The stoppage started with the disaffection amongst the plumbers in the Swansea area. So large is the surplus stock of acid, that there seems to be no immediate prospect of a re-start. At present, the repairing staff is very busy. This is one of the few oxalic acid works in the country, and some of the workmen have been continuously employed for over forty years.

Import of Dyestuffs

By the Proclamation of February 24, 1919, the importation into the United Kingdom of the following products was prohibited except under licence, viz. :—

All derivatives of coal tar generally known as intermediate products capable of being used or adapted for use as dye stuffs, or of being modified or further manufactured into dye stuffs.

All direct cotton colours, all union colours, all acid wool colours, all chrome and mordant colours, all alizarine colours all basic colours, all sulphide colours, all vat colours (including synthetic indigo), all oil, spirit and wax colours, all lake colours, and any other synthetic colours, dyes, stains, colour acids, colour bases, colour lakes, leuco acids, leuco bases, whether in paste, powder, solution or any other form.

At the same time, in accordance with the arrangements outlined in a White Paper issued some months ago (Cd. 9194) setting out the Government scheme for affording State assistance to the dye-making industry, a special Committee, known as the Trade and Licensing Sub-Committee, was established with offices at Danlen-buildings, 53, Spring-gardens, Manchester in order to determine the kinds and quantities of the dyestuffs which were to be licensed for import and generally to deal with all questions relating to such importation.

This sub-committee consists of: Dr. A. Ree and Mr. J. Turner, representing the dye-manufacturing industry; and Mr. W. E. Kay and Mr. Thorp Whitaker, representing the dye using industry, with Mr. W. Graham, of the Board of Trade, as secretary.

In order that there should be no undue delay in dealing with applications to import dyestuffs during the first few weeks whilst the necessary organisation was being set up, the Committee issued a general licence permitting the importation of all dyestuffs of bona-fide American, French or Swiss origin, but this concession was withdrawn on April 9, and since that date licences have been necessary for the import of all consignments of dyestuffs coming into this country whatever their origin.

Whilst the regulation of the import of dyestuffs was primarily necessitated in order to prevent the free access of German materials to this market, it was felt that some measure of control was desirable over all imports if the scheme was to be thoroughly effective. It was, therefore, decided that a Central Importing Agency should be established under the direct control of the Committee, through which all imports of dyestuffs must pass at some stage. As soon as the Committee are in a position to consider applications for the import of German dyestuffs, which will not be until after the withdrawal of the Trading with the Enemy Regulations, the Central Importing Agency will be the medium through which supplies are made available to consumers. Except in the case of German dyes, the Agency will now undertake, if desired, the purchase of dyestuffs abroad on behalf of consumers, but where it is desired to make purchases direct or through recognised merchants, the goods will merely require to be consigned to the Agency for the account of the particular consignee and the shipping documents made out accordingly. For its services, the Agency will charge a commission of 1 per cent. on the invoice value of the goods with a minimum charge of 5s., but this charge will not of course include any incidental expenses, such as freight, insurance, storage, &c., which must naturally be additional and borne by the importer. The offices of the Central Importing Agency for the time being are at 21, Spring-gardens, Manchester.

Any firms desiring further information on the subject or wishing to make application for an import licence are advised to communicate direct with the Secretary of the Licensing Sub-Committee, at the address already given (53, Spring-gardens Manchester).

The Council of the Institution of Mining Engineers decided to present the medals of the Institution this year to Dr. Auguste Rateau (of France) and to M. Watteyne (of Belgium), in recognition of their work in the interests of mining, and as a tribute to two of our Allies in the war. Dr. Rateau and M. Watteyne were unable to be present at the annual general meeting of the Institution, held at Burlington House last week; and, in their absence, the medals were presented by the President to Professor Louis (on behalf of Dr. Rateau), and to Sir William Garford (for M. Watteyne).

The British Chemical Industry

A Norwegian Estimate

In the "Year Book of the Norwegian Chamber of Commerce," in London, there is an interesting review of the present position of the chemical trade of Great Britain.

Conditions in the chemical trade in Great Britain (the writer states) remained so abnormal throughout 1918 that no attempt to give a detailed review of the market movements would serve any useful purpose, or be any guide for the future. Chemical works were for the most part controlled by the Government, and the great effort required to bring the war to a successful conclusion caused such demands for material for national purposes to be made on the British chemical works as to leave but short supplies over for ordinary commerce. Manufacturers had increased difficulties to contend with in the shape of scarcity of coal and raw materials, lack of railway and transport facilities, and also lack of labour owing to the calling up of every available man for the army. Imports and exports were much interfered with by lack of shipping and transport, and by the restrictions imposed by our own and other Governments.

Nevertheless, business during 1918 was better than had been anticipated when the year began; and the year closed with a feeling of optimism at the prospects of a return to peace conditions in the not too distant future. How long it will yet take before conditions approaching normal are reached it is impossible to foretell. While in certain directions increased production and competition may ultimately tend to bring prices to the neighbourhood of the pre-war level, on the other hand, the increase of wages and the increased cost of coal and other raw materials and also of transportation contribute to make any rapid reductions unlikely. The absorption of high-priced surplus stocks in the hands of all the Allied Governments have also to be reckoned with before conditions can become normal.

One of the most remarkable features has been the huge war increase in the British production of sulphuric acid—estimated at 60 per cent. in excess of the pre-war production. While a portion of the now existing plant will have to be dismantled it is expected that a large proportion of the new output will be absorbed in increased production of fertilisers. Other notable developments have been the huge production of dyes in Great Britain and the amalgamation of British Dyes, Ltd., and Messrs. Levinsteins, Ltd.; and also the amalgamation of the principal explosives works in the Explosives Trades, Ltd.

The future prospects of the British chemical industry appear very promising. As a result of the cutting off of supplies from Germany and the demands made for war purposes, immense developments in our chemical manufacture had to be made during the war; all the large works extended their plant and their range of manufactures, and new works have sprung up. The immediate outlook for heavy chemicals in particular is considered to be good.

The overseas demand is expected to be heavy and will have to a large extent to be supplied from Great Britain; while for months past the domestic demand for soda, carbonate of soda and crystals and chemicals for match-making have been much in excess of the supply. Much will depend on the labour situation, though, as far as the leading British chemical works are concerned, it is to their credit that they have so far managed to settle their labour difficulties without any serious trouble developing. Great Britain has high hopes of taking a large share of the trade previously held by Germany in many markets, including Scandinavia. Especially does this apply to Norway.

The courage of the Norwegian seamen, in face of the submarine menace and the assistance given by Norwegian chemical works in furnishing large quantities of urgently needed supplies for allied munition purposes, are full recognised; and it is safe to say that when, during the darkest hours of the war, Norway stood out amongst neutral countries as clearly pro-Ally, many British firms made a resolve to make a special effort to develop their business with Norway as soon as this should be possible. Many of these resolutions will certainly bear fruit in the near future, and should be of great advantage to both countries.

Baltic Chemical Co.—In the advertisement of this company in last week's issue, the cable address was inaccurately given. The correct cable address is "Eastexpo, New York."

From Week to Week

In honour of Mr. J. H. Whitley, M.P., the Industrial Reconstruction Council will give a dinner at the Connaught Rooms on Wednesday, July 9, at 7.15

Sir Henry H. Howorth, F.R.S., has been elected president of the Viking Society for Northern Research, in succession to Mr. A. W. Johnston, F.S.A.Scot., founder of the Society.

The University of Cape Town, South Africa, requires a Professor of Inorganic Chemistry, at a salary of £800 a year, with a temporary war bonus for a married man of £78 a year. The candidate appointed will be expected to carry on research work

The Council of the Institution of Civil Engineers have decided to reopen the Yarrow and William Lindley scholarships, which have been in abeyance during the war, for the nomination of new scholars.

The Governing Body of Emmanuel College, Cambridge, offers two exhibitions, each of the value of £50 and tenable for two years, to research students entering into residence at the college next October.

Publicity was given in a Sheffield paper this week to a report of an agreement for the amalgamation of the Birmingham Small Arms Co. and a well-known Sheffield firm, William Jessop & Sons; but no confirmation of the report has yet appeared.

Some criticisms of the Electricity Supply Bill are put forward by the Provincial Electric Supply Committee of the United Kingdom, which represents 122 electric supply companies holding Provisional Orders.

Mr. Thomas Fairley, of Leeds, city analyst of Leeds since 1873, at one time chemistry master at Leeds Grammar School and Lecturer in Chemistry at Leeds School of Medicine, has left estate of the value of £5,456.

As the Danish Government has given a general guarantee not to re-export supplies to enemy countries, all restrictions on exports from the United Kingdom to Denmark have been removed. Exporters should, however, satisfy themselves that the goods are not subject to any Danish import prohibition.

The Brazilian Commercial Mission which is now in England includes Dr. Britto, who is much interested in hydro-electric development; Dr. Simonsen, a young engineer, who was responsible for the first shipment of frozen meat from Brazil to Great Britain; and Senhor Guisard, an authority on textile industries.

According to *Stubbs' Weekly Gazette*, the failures in the United Kingdom for the week ended June 21 were 29, an increase of six. The number of bills of sale registered and re-registered was 112, an increase of 53. Mortgages and charges registered by limited companies amounted to £473,473, the amount authorised (where stated) being £1,743,750.

The directors of the Nestlé and Anglo-Swiss Condensed Milk Company propose to issue 200,000 new shares at par value of 400 f. each, which will be offered to the shareholders in the proportion of one new to one old, at a subscription price of 200 f. for each new share; the payment of the remaining 200 f. for each new share will be made by the company out of its reserve funds.

On the advice of Sir Hesketh Bell, Mauritius is about to follow the lead of Dominica and other West Indian Colonies and resort to the cultivation of lime trees on an extensive scale. The Department of Agriculture is also stimulating the manufacture of ground nut oil, for which there is an increasing world demand, by encouraging the cultivation of ground-nuts, known locally as pistache nuts.

The shareholders of the Havana Oil Co., Ltd., at a general meeting this week, confirmed a provisional agreement for the sale to the Oil Trust, Ltd., of the company's interest in the Cuban Asphalt Co., Ltd., and passed a resolution increasing the capital of the company to £200,000, by the creation of 1,200,000 new shares of 2s. each, ranking in all respects *pari passu* with the existing shares.

In some quarters it is felt that, in the proposals now before the country for the supply of electricity, the claims of gas as an agent for the provision of heat and power are being somewhat overlooked, and that there is need for a broader view of the whole fuel situation. So far as utilising the heat contained in the coal is concerned, the gas interests aver that in many cases they can show greater efficiency than is attained with electrical methods; and a statement drawn up at the suggestion of the President of the Institution of Gas Engineers, which forms the basis of an article on the subject appearing in the June issue of the *Times Engineering Supplement*, now published, may be said to carry the war into the enemy's country.

It is proposed to extend the Textile Industries, Colour Chemistry, and Dyeing Department of Leeds University by adding a school of research and teaching in the science and technology of silk manufacture. The existing department has been provided at a cost of £75,000 by the Clothworkers' Company, who also contribute £4,000 a year towards its maintenance. Subject to certain conditions, the Clothworkers' Company are disposed to erect the necessary buildings for the new silk school, which are estimated to cost £20,000. The Company will be prepared to do this provided that it is shown that adequate provision will be made for the equipment and maintenance of the school. This will depend to a large extent upon the Silk Association as representing the industry.

An interesting New York development last week (according to the *Financial News* correspondent), was the resignation of Mr. Mark L. Requa, chief of the Oil Division of the Fuel Administration at Washington, to become associated with the Sinclair oil interests. Mr. Requa is a man of high standing in his chosen field, and his acquisition by the Sinclairs is significant. For some time there have been rumours of consolidations of the various independent systems, and the merging of Sinclair Gulf and Sinclair Refining in o the Sinclair Consolidated has already been accomplished. The plans of these independents, so called, however, are understood to be much more ambitious. If the rumours are to be believed—and in many influential circles they are given full credence—all independent oil companies outside of the Standard Oil Co. are to be consolidated into one organisation, which will give that pioneer among trusts opposition of a kind it has never before encountered. It is impossible to say at this time how much there is in these reports, but the fact remains that oil stocks have been favourites for some months.

At a national conference of members of the Federation of British Industries on Monday, a resolution was passed, on the motion of Lord Leverhulme, viewing with the gravest alarm the Bill now before Parliament, and strongly protesting against a measure which will impede the trade of the country, curtail the liberty of the subject, and substitute a bureaucracy for the authority of Parliament. Lord Leverhulme said he had always marvelled how organised labour in this country could support nationalisation of the railways, coalmines, or any other industry. Nationalisation would undo the great trade unions, for there would only be one employer. Behind that employer would be the Army and the Courts, and there would be no arbitration or umpire between employer and employee. While organised labour was clamouring for nationalisation in this country, where 85 per cent. of the workers were in trade unions, the rates of pay in the United Kingdom were only half what they were in the United States, where only 15 per cent. of labour was organised in trade unions, and where nationalisation was not a cry. Capital—the greatest friend of modern civilisation—had made the factories and increased the rate of pay enormously in the last century. Private enterprise was the only middle course between bureaucratic Socialism and Bolshevist Syndicalism.

Concealed Iron Ore and Coal.

Among other matters, the second report of the Conjoint Board of Scientific Societies, which has just been issued, refers to some magnetic surveys which have been carried out at Irthlingborough and Melton Mowbray. The results prove, it is stated, that the relatively small magnetic disturbances at the former place may be correlated with the presence there of the bed of Northamptonshire iron ore; and it is considered that, with suitable modification of the instruments, the small magnetic disturbances caused by the Jurassic ironstones are capable of detection, and may be of use in determining the boundaries of concealed beds of these ores in areas not affected by larger disturbances due to other causes. The Melton Mowbray disturbances, on the other hand, cannot be attributed either to Jurassic ironstone or to sedimentary deposits underlying the area, but appear to be connected with the tectonics of the deep-seated formations. The investigation therefore promises to throw light on the tectonics of the older rocks when overlain by more recent formations, and thus to afford assistance in solving problems of great practical importance, such as the determination of the limits of concealed coalfields.

Reviews

PULVERISED COAL SYSTEMS IN AMERICA. By L. C. HARVEY. H.M. Stationery Office. 2s. 6d. net.

COAL consumers are well aware that developments in connection with the coal-mining industry, both recent and prospective, emphasise more than ever the need of the more efficient use of fuel for all industrial purposes. It is also well known that one of the most efficient means of burning coal, if coal must be used directly as fuel, is firstly to dry it thoroughly, and then reduce it to the form of an impalpable powder. In this form it assumes some of the desirable characteristics of both gaseous and liquid fuels. It may be burnt "in suspension," and most of the difficulties incidental to the use of coal on ordinary stationary or moving grates are eliminated, while the advantages of close regulation, as well as the high temperatures incidental to almost perfect and complete combustion, are obtained. Consideration of these advantages and the possibilities which they present of increased efficiency in the use of fuel in many British industries is invited in the first Special Report of the Fuel Research Board on "Pulverised Coal Systems in America," by L. C. Harvey, which deals comprehensively with the application of powdered fuel to both metallurgical process work and steam generation in that country. It would be wrong, however, to assume that British manufacturers had not already considered and weighed the advantages and disadvantages of powdered fuel; and, in a prefatory note, Sir George Beilby, F.R.S., Director of Fuel Research, hastens to prevent any such assumption, and advocates reconsideration of this aspect of the fuel conservation problem in the light of American experience. The extensive adoption of powdered coal as fuel (which is incidental to the use of rotary kilns in the Portland cement industry in this country) is, perhaps, the best proof that, with apparatus specially adapted for its use, its advantages, particularly as they affect output, are well recognised. The only alternative fuel capable of working rotary kilns to equal advantage is relatively expensive oil fuel. For steam generation there are, however, other fuels available, which have the great advantage of being suitable for use with existing apparatus. Even in the cement industry it is realised that the advantages of powdered coal are largely off-set by the cost and trouble incidental to the preliminary selection, drying, and grinding of the coal; and it is probably upon the careful attention given to each of these stages of preparation that advantage rests, rather than upon any inherent advantage of the system. Given an equal amount of close expert care and attention, greatly improved results would be obtained from the use of ordinary solid fuel. In this connection there is one aspect of the question which has very considerable commercial, practical, and even national significance, which is not emphasised in the Report. The commercial and practical advantages which accrue from the judicious blending of our native coal and manufactured fuels —which, fortunately, are available at widely different prices in almost endless variety—warrant closer attention. By means of the "Sandwich" system of mechanical stoking, solid fuels, such as bituminous coal slack and gas coke, having widely different chemical and physical characteristics, are now being blended and used with very gratifying results on existing mechanical stokers for the purpose of improving the efficiency and intensity of combustion, and also for reducing the fuel cost of evaporation. The large user, who is usually also a shrewd buyer, takes advantage of variations in prices, selecting those fuels which for the time being are the most advantageous; and, having ascertained their proximate analyses, he proceeds to compound a mixture of two or more different kinds of coal that will conform to his requirements at minimum cost. This is one of the advantages of the pulverised coal system which has very considerable commercial importance, having, at the same time, an important bearing upon the larger consideration of coal conservation.

By means of this system it will be evident that small-sized but relatively good bituminous coal, now discarded in the pits as practically unsaleable, as well as gas coke, breeze, anthracite "billy" and "breaker" duff, &c., may be recovered, blended, and utilised to the best advantage.

As purveyors of manufactured fuels—solid, liquid, and gaseous—those in charge of the greater gas-supply undertakings fully realise the difficulties incidental to the distribution of fuels for the use of which special apparatus is required; and, considered in the light of their experience, the prospect of daily deliveries, "in drums," of pulverised fuel for domestic use, in competition with gas and electricity, is forbidding in the extreme, in view not only of the obvious objections to the distribution of finely powdered coal in small quantities, but also in view of the relative cost of distribution of fluid and solid fuels. For similar reasons it is difficult to foresee the extended use of powdered coal as fuel for locomotives in this country, or for marine propulsion. With one of the author's conclusions the present writer is in hearty agreement, namely, "that there is little or no economy to be effected by the introduction of pulverised coal burning apparatus, in substitution for existing efficient mechanical stoker installations." Existing mechanical stokers can be adapted to use coke, which not only effects smokeless combustion, but from which the recovery of valuable by-products has already been secured by preliminary carbonisation. It is, moreover, well known that by means of blending, coal slacks hitherto considered unsuitable are now being carbonised along with coking coal, and are thus being converted into an excellent coke fuel.

E. W. L. N.

ANNUAL REPORTS OF THE SOCIETY OF CHEMICAL INDUSTRY. 1918. Vol. III. Pp. 495. 6s. 6d. (to members).

Since the introduction of the Annual Reports of the Society of Chemical Industry each volume has been considered an unqualified success by all classes of scientific readers, and the current volume is no exception. The practice of obtaining the services of different sectional contributors for each volume is a good one, and should be continued, since it prevents the various accounts of the annual progress becoming purely formal in character. The present volume contains twenty-two sections covering the whole field of the more important chemical industries, and includes two subjects not dealt with in the previous volumes, viz., Agricultural Chemistry, by E. J. Russell, and Foods, by H. W. Bywaters. The society is in this way assisting in the good work of stabilising one of our most important industries. Such sections are illuminating to those who have suffered during the last few years from one of the by no means minor discomforts of the war, namely, "ersatz" foods of varied composition, and they are also of assistance to the public analyst.

In the section on Plant and Machinery, by J. W. Hinchley, great activity is still noted in the preparation of rustless and acid resisting alloys. The writer has not, however, referred to the various recently prepared cobalt alloys for which extraordinary claims are made. Evaporators and heat interchangers still occupy an important position in plant design. Since design of plant of this character is based upon approximation formulæ or experimental tests when operating with certain fluids, it might prove advantageous to incorporate in this section a short list of the more important scientific and mathematical papers applicable to this branch of chemical engineering. This applies more particularly to the design of heat interchangers where calculations based solely upon the specific heats of the fluids, their flow rates,

and the diathermacy of the material, lead to results incompatible with experimental tests. Data collected from a study of turbulence and skin thickness, however, lead to formulæ applicable to plant design.

The sections on fuel, gas, and mineral oils are respectively compiled by J. T. Dunn, Alwyne Meade and A. Philip. The development of coal dust firing for steam raising, the use of tars and liquid naphthalene in internal combustion engines, the production of home produced liquid fuels from shales, low temperature carbonization of coals, and the search for natural oil fields all indicate that the British fuel technologist is fully aware of his heavy responsibilities. The stimulus to the recovery of valuable by-products in the gas industries is beginning to operate on a more permanent footing, and the possible introduction of legislation permitting the sale of gas on a thermal unit basis may well create a revolution in coal economy. The technical production of fats from saturated hydrocarbons and alcohols from the olefines in industrial gases are two developments which are at present occupying the minds of research chemists.

In the section on colouring matters and dyes, by G. T. Morgan, frequent mention is made of the various catalytic processes for accelerating the production of intermediate substances, amongst which the direct catalytic oxidation of the hydrocarbons, such as naphthalene, bids fair to become operative on a technical scale.

Considerable progress is recorded in the utilisation of waste liquors from paper mills in the sections on Paper, by J. F. Briggs, and on Bleaching, by S. H. Higgins, both in the production of alcohol, the yield of which is barely over 1 per cent. of the liquor treated, and in the preparation of fuels from precipitated liquor and wood distillation products. In spite of the enormous dilution of the waste liquor an economic solution of the precipitation and concentration difficulty appears to have been found in countries possessing cheap sources of power such as Norway and Sweden.

During 1918 a very considerable amount of research work on the synthesis and oxidation of ammonia and the various problems connected with the manufacture of ammonium nitrate and nitro explosives has been carried out by various Government Departments, and it is to be hoped that all which is deemed advisable will be published to supplement the records summarised in this volume by H. A. Auden. It is a pity that no reference is made to H. Meyer's paper (Ceramic Society, September, 1918) on Zirconia, which contains a useful summary of the commercial uses of Zirconium and formulæ for the manufacture of refractory bricks with particulars as to their behaviour on firing.

The section on glass and refractory materials by W. J. Rees is most comprehensive, whilst that on the metallurgy of iron and steel, by C. O. Bannister, could well have included some of the recent work on electrolytic iron, with some further information on the progress of special steels containing the rarer elements.

The articles on indiarubber and leather, compiled by D. F. Twiss and F. C. Thompson, include information which indicates that the colloid chemist is slowly but surely coming into his own in these industries.

The advances to be recorded in the Sugar and Fine Chemical Industries, by J. P. Ogilvie and G. Barger, indicate on the one hand a strong revival of the British cane sugar industries, but on the other a startling activity on the part of the German physiological chemists.

The rapid progress of the activated sludge process in sewage purification is indicated in E. Ardern's review of the year's work on sanitation; it is also interesting to note that chlorine gas is now the *sine qûa non* for water sterilisation. The Reports conclude with a really excellent article on photography, by B. V. Storr.

In conclusion, it may be pointed out that the Reports appear to be developing on the lines of a continuous narrative and criticism, and they do not now merely represent a catalogue of scientific developments and literature. This is a feature which is strongly to be commended, for the independent views of the respective authors are thus obtained, and the whole volume becomes very much more readable. The writer has, in fact, only one suggestion to make, and that is in respect to illustrations. These, unfortunately, are conspicuous by their almost complete absence, with the result that in many cases only a very imperfect idea of some of the apparatus can be obtained. In order to be quite complete a section should be introduced on the subject of design in chemical engineering plant, in which might be included various data and useful tables.

E. R.

"THE ENGINEER'S YEAR-BOOK" for 1919. Edited by H. R. KEMPE, M.Inst.C.E., with the collaboration of numerous specialists. London: Crosby Lockwood & Son. 25s. net.

Mr. Kempe's Year-Book has long ceased to become a convenience; it is, in fact, an absolute necessity. The only direction in which one might be disposed to disagree with its editor is, perhaps, in the choice of the title. To call it an *engineer's* handbook is to misname it when consideration is given to the information it contains—information which is just as valuable to the industrial or academic chemist as to the many descriptions of engineers. The 1919 edition contains no fewer than 2,448 pages, or an increase in number of 280 per cent. as compared with the original edition published a quarter of a century ago. The volume is, of course, far too obese to be classed as a pocket book, but it is just the kind of ready reference which is required for the desk, and it succeeds where the pocket book must always fail, in that it is just about as complete as anything of the kind could be.

The opening pages form a useful summary of the progress made in various directions during the year 1918, and such subjects are dealt with as non-ferrous metals, gasworks processes, fuel, refractories, and nitrogen fixation. Naturally, in a review of this kind it is the chemical engineering and scientific sections—apart from the purely engineering matter—which demand chief attention, and one notes that among the new sections introduced is one dealing with fuel by Mr. Harold Moore, with others on pulverised coal by Mr. L. C. Harvey (the representative of a Government Department who travelled specially to America to study the subject), and on explosives, which are in the hands of Professor Hodgkinson.

Most of the sections have been re-written and brought up to date, and so far as the requirements of the chemist are concerned he will find any amount of helpful information on principles affecting the plant and apparatus commonly employed on his works. Complete sections dealing with the work of the chemical rather than with that of the civil or mechanical engineer will be found on such subjects as blast-furnace practice, mining, water filtration, sewage disposal, carbonisation, and refrigeration. Section 38, dealing with workshop recipes and processes, is composed of a collection of useful everyday points, often inaccessible, but of the kind to prove vexatious to the management at odd times. For instance, everyone in charge of a works will occasionally want to refer to hints in connection with painting, lacquers, and varnishes, and a study of the suggestions here given will certainly be conducive towards the saving of both time and money. Speaking of time-saving, one might venture to suggest that Mr. Kempe could effect a single improvement in his volume, and that by following the practice of the American handbook by Kent, in which any section may be turned up immediately by means of an ingeniously arranged "thumb" index.

A. M.

References to Current Literature

Only articles of general as distinct from specialised interest are included and given in alphabetical order under each geographical subdivision. By publishing this digest within two or three days of publication or receipt we hope to save our readers time and trouble; in return we invite their suggestions and criticisms. The original journals may be consulted at the Patent Office or Chemical Society's libraries. A list of journals and standard abbreviations used will be published at suitable intervals.

British

CHEMICAL ENGINEERING. Relation of the works' chemist to the engineer. F. C. A. H. Lantsberry. *Chem. Trade J.*, June 21, 542. Abstract of paper before Birmingham Branch of Institute of Chemistry.

COMBUSTION. Spontaneous combustion. W. Smith. *J. Roy. Soc. Arts*, June 20, 500-507. Deals particularly with ships' cargoes, coal, charcoal, textile fibres, hay, tobacco, certain chemicals, dyes and pigments.

COMPRESSED GASES. Gas cylinders. *Engineering*, June 20, 809-810. Critical notes and suggestions for improvement.

GAS. Utilisation of gaseous fuel in commercial practice. F. W. Epworth. *Gas J.*, June 24, 804-806. Conclusion of paper already noted. (*Chem. Age*, No. 1, p. 17.)

Carbonising plants of the future. H. D. Madden. *Gas J.*, June 24, 809-811. The author considers that the vertical retort is best adapted to present-day needs.

RESEARCH. Some problems in chemical industry. R. F. Bacon and W. A. Hamor. *Chem. Trade J.*, June 21, 543. Abstract of a paper read before the American Chemical Society.

STONEWARE. Standardisation of chemical stoneware. H. Nielsen. *Trans. Ceram. Soc.*, 1918-19, 18, 182-229. Contains detailed suggestions for standardisation.

Colonial

BUILDING MATERIALS. Importance of testing building materials E. MAVAUT. *Pulp and Paper Mag.*, May 29, 505-507.

French

BOILERS. Boiler-feed waters. J. H. Mathieu. *Rev. Prod. Chim.*, May 31, 257–261. Notes on corrosion of iron and steel.

CHAUNY. Visit to Chauny. *Chem. et Ind.*, May, 81-92. Illustrated description of visit to the ruins of the Saint Gobain chemical works.

HELIUM. Industrial production of helium. F. G. Cottrell. *Chim et Ind.*, May, 29-37. Illustrated record of American work during the war.

IRON. Treatment of low-grade iron ores by magnetic concentration. H. Louis. *Chim. et Ind.*, May, 15-28. A valuable descriptive article.

LITERATURE. Organisation of international recording of literature and the role of chemical societies. P. Otlet. *Chim. et Ind.*, May, 51-58.

ORGANISATION. The Interallied Chemical Conference. *Chim. et Ind.*, May, 1-92. A full account of the proceedings of the Conference held in Paris on April 14-16.

PATENTS. American patents. J. Pennie. *Chim. et Ind.*, May, 46-50.

POTASH. The potash situation in the United States. C. MacDowell. *Chim. et Ind.*, May, 41-42.

American

BOILERS. Practical operation of industrial boilers. W. E. Snyder. *Proc. Eng. Soc. W. Pennsylvania*, Mar., 59-116. A useful and suggestive paper.

CONCRETE. Effect of curing conditions on wear and strength of concrete. D. A. Adams. *Bull. No. 2, Structural Materials Research Lab., Lewis Inst., Chicago*, May. A number of tests are described.

DYES. The dyestuff plants and their war activities. T. W. Sill. *J. Ind. Eng. Chem.*, June 1, 509-512. Notes on the work of German dye factories.

GAS MASKS. Methods of testing gas masks and absorbents. A. C. Fieldner, G. G. Oberfell, M. C. Teague and J. N. Lawrence. *J. Ind. Eng. Chem.*, June 1, 519-540. A full description of tests used in the United States.

Use of Army gas masks in atmospheres containing sulphur dioxide. A. C. Fieldner and S. H. Katz. *Chem. and Met. Eng.*, June 1, 582-586. Army masks can be used with advantage in many branches of chemical industry.

LITERATURE. The art of searching chemical literature. H. Hibbert. *Chem. and Met. Eng.*, June 1, 578-581. Suggestions as to the best books and journals for reference.

Library service in industrial laboratories. *J. Ind. Eng. Chem.*, June 1, 578-589. A series of papers on technical libraries, read before the American Chemical Society.

NITROGEN FIXATION. Commercial oxidation of ammonia to nitric acid. C. L. Parsons. *J. Ind. Eng. Chem.*, June 1, 541-552. Description of work at the U.S. Government Nitrate Plant. (See also *Chem. Age*, No. 1, p. 17.)

How the nitrogen problem has been solved. H. J. M. Creighton. *J. Franklin Inst.*, June, 705-735. Conclusion of paper already noted (*Chem. Age*, No. 1, p. 17). Deals with the oxidation of ammonia and comparative costs of production by various processes. A bibliography is added

OIL SHALES. Oil shales. D. E. Winchester. *J. Franklin Inst.* June, 689-703. Notes on the origin and utilisation of American oil shales.

ORGANISATION. Industrial Germany, her methods and their defeat. F. P. Garvan. *J. Ind. Eng. Chem.*, June 1, 574-578. Address to National Cotton Manufacturers' Association, New York.

PLANT. Condition of chemical plants in Germany. F. Pope. *J. Ind. Eng. Chem.*, June 1, 512.

Centrifugal agitator and distributor. H. E. Jacoby. *Chem. and Met. Eng.*, June 1, 598. Description of a device designed by C. C. Thomas.

Valveless pump. *Chem. and Met. Eng.*, June 1, 599-600. Description of the Dourte pump.

PLATINUM. Comparative tests of Palau and Rhotanium as substitutes for platinum laboratory utensils. L. J. Gurevitch and E. Wickers. *J. Ind. Eng. Chem.*, June 1, 570-573. These alloys may replace platinum for many purposes, but cannot be used as anodes.

RUST PROOFING. Metallic coatings for rust-proofing iron and steel. Part III, Bibliography. H. S. Rawdon, M. A. Grossman and A. N. Finn. *Chem. and Met. Eng.*, June 1, 591-592. Bibliography of corrosion and the coating of metals.

WARFARE. The Roving Division, Chemical Warfare Service. U.S.A. W. S. Bacon. *J. Ind. Eng. Chem.*, June 1, 513-516. Description of the Government plant for testing various gases.

The Personnel Section, Chemical Warfare Service, U.S.A. F. E. Breithut. *J. Ind. Eng. Chem.*, June 1, 516–518.

Italian

FERTILISERS. International movement in fertilisers and chemica products useful to agriculture. *Documentary Leaflets of Internat. Inst. of Agriculture, Rome*, May. Statistical review for 1918 of production and trade in fertilisers, sulphur and copper sulphate.

German

BRIQUETTES. Disadvantage of the use of pitch dust in briquetting. P. M. Grempe. *J. Gasbeleucht.*, May 10, 243-244.

GAS. Studies with gas retort furnaces. K. Bunte. *J. Gasbeleucht.*, May 3 and 10, 221-226, 237-240. Reports of a series of retort trials.

Direct extraction of pitch and tar oils from crude coke-oven or illuminating gas. W. Emminghaus. *J. Gasbeleucht.*, May 3, 226-229. Description of the fractional cooling process.

PATENTS. Non-extension of the life of patents. F. Pollack. *Chem. Zeit.*, May 31, 317-318.

PLANT. Developments in plant for inorganic chemical industries during the war. *Chem.-Zeit.*, May 29. Conclusion of article already noted (*Chem. Age*, No. 1, p. 17), recording a number of patents.

Patent Literature

Complete information is only obtainable by purchase of the original patent, abstracts being rarely sufficient. Where complete specifications are "open to inspection" but not yet published, fuller information will usually be given in order to obviate a personal visit to the Patent Office. The inclusion of foreign patents is under consideration, and this and other improvements in THE CHEMICAL AGE *service will be developed in accordance with the suggestions and requirements of our subscribers. Illustrations and diagrams will be used as far as possible to shorten written descriptions.*

Applications

Alcohol, manufacture of. 13,338. Sir C. H. Bedford and A. B. C. Rogers.

Allyl ester of 2-phenylquinoline-4-carboxylic acid, manufacture of. 13,502. Soc. of Chem. Industry in Basle.

Ammonia, manufacture of sulphate of. 13,757. Koppers Co. and H. Wade.

Ammonia, recovery of. 13,816. W. J. Chrystal.

Aromatic nitro-compounds, process for reducing. 13,619. S. H. Davies and J. Tcherniac. Also (13,620) process for manufacture of alkyl sulphates.

Benzoic acid, production of. 13,293. Etablissements Poulenc Frères and W. I. Thompson.

β—halogen-ethylaminobenzoic esters and their derivatives, process for manufacture of. 13,761. Soc. Chimique des Usines du Rhone, late Gilliard, Mownet, and Cartier.

β—alkylamino-ethylaminobenzoic alkyl esters and their derivatives. 13,762. Patentees as in 13,761.

Cinders from coal ash, device for removing. 13,662. G. F. Burden.

Disinfecting fan. 13,251. R. Woodrow.

Fertilising material, manufacture of. 13,686. W. Dederich.

Formaldehyde and aromatic derivatives, manufacture of condensation products from. 13,356. A. G. Bloxham (Durand et Huguenin Soc. Anon.)

Fuel, artificial. 13,496. American Linseed Co.

Furnaces, device for enabling condition of combustion to be ascertained. 13,636. J. G. W. Hintze.

Gasworks, hydraulic mains for. 13,178. A. Simmonds.

Gas, process for making. 13,606 and 13,607. D. E. Campbell.

Glass, working. 13,268. H. S. Hatfield.

Hydrocarbons, treating. 13,374. B. Andrews.

Lead, refining. 13,597. Locke, Blackett & Co.

Mono- and di-β-oxyethyl-aminobenzoic esters and their derivatives, process for manufacture of. Soc. Chimique des Usines du Rhone.

Pyrometer or temperature alarm instrument. 13,357. J. F. J. Malone.

Soap, liquid. 13,727. D. Stevenson.

Still-heads. 13,754. Boake, Roberts & Co., and J. H. Durrans.

Sulphite Boilers. 13,654. Atkiebolaget Vaporackumulator, and J. K. Ruths.

Sulphuric acid, plants for treatment of. 13,660. G. E. Clark.

Water gas, producing enriched. 13,733. J. W. Gibson and R. L. Wyman.

Abstracts of Complete Specifications

CHLORINE, PROCESS FOR EXTRACTION OF. 126,992. P. L. Hulin, 6, Rue Felix Poulat, Grenoble, France.

The chlorine is absorbed by means of a solution of a lower chloride (such as $Fe\,Cl_2$) which passes to the state of a higher chloride, such as $Fe_2\,Cl_6$. Subsequently, the electrolysis of the higher chloride, and a circulation of the electrolyte which passes from the anode to the cathode, thus yielding on the one hand pure industrial chlorine, and producing in the cathodic solution a lower chloride capable of fixing a fresh quantity of chlorine, thus ensuring continuity of operation.

HYDROGEN, PRODUCTION OF. 127,018. Compagnie Générale d'Electro-Chimie de Bozel, 22, Rue de l'Arcade, Paris.

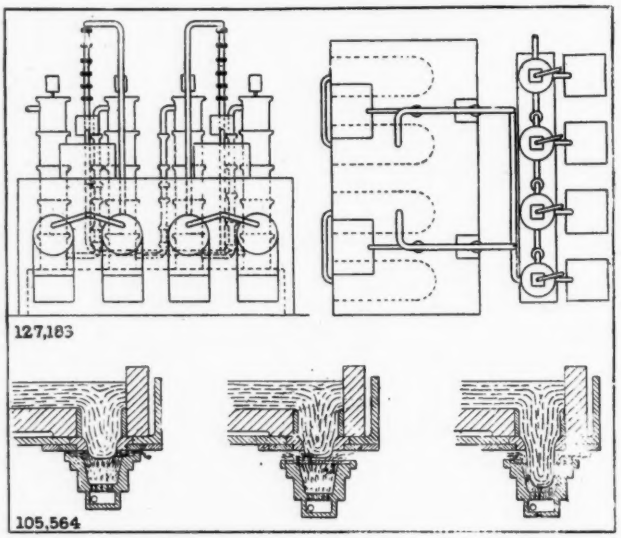
An improved process for the production of hydrogen by decomposition of water under the action of silicon or aluminium, either alone or mixed or combined with other ingredients which do not affect the reaction in the presence of an alkaline earth base, supplemented by a small quantity of alkali.

SMOKE CLOUDS FOR MILITARY AND SUCH PURPOSES. 127,031. E. E. F. Berger, 3, Rue de Valence, Paris.

The invention relates to various methods for producing smoke clouds, the mixtures employed for the purpose being described in the specification.

MOLTEN GLASS, METHOD OF SEPARATING FROM MASS. 105,564. O. M. Tucker and W. A. Reeves, of Columbus, Ohio, U.S.A. *See illustration.*

The invention relates to a method of separating charges of viscous glass from the viscous mass, and consists in permitting the glass to extrude through an unthrottled aperture into space, and periodically severing the extruded portions when they have attained a predetermined length. The illustrations show, firstly, a vertical section indicating the position of the combustion chamber or cup which is moved into the position shown imme-



diately after each cutting action. The second figure illustrates the manner in which the glass may be permitted to extrude while being heated. The third figure shows the manner in which the cup may be used to permit and yet retard the advancing action of the extruding glass with a resultant effect upon its form. The method described permits, it is claimed, of the separation of definite charges and the delivery of those charges into moulds without entailing the usual effects due to chilling, stratification and coiling, the result being that glassware free from blemishes is obtained.

CATALYSTS AND CONTACT MASSES, ACTIVATION OF. 127,025. E. B. Maxted, 63, Highgate Road, Walsall, and G. R. Ridsdale, 138, Lichfield Street, Walsall.

The invention relates to a process whereby the activity of an iron or other catalyst may be maintained continuously and constantly at an activity equal to the increased but transitory activity obtained by the incorporation in, or addition to, the catalyst of alkaline promoters in the usual manner. According to the process employed, instead of incorporating an alkaline promoter with the contact mass, a current of the gas undergoing reaction, containing the vapour of sodium or potassium hydroxide or other alkaline compound, preferably in proportion such that the partial pressure of the alkaline promoter in the gas is equal to or greater than its vapour pressure at the temperature at which the catalytic reaction in question is carried out. The following examples illustrate the scope and manner of carrying out the invention in practice:—(*a*) For the production of hydrogen by

the so-called "continuous" method, involving the interation of the carbon monoxide contained in water gas or other commercial reducing gas and steam, in presence of an iron or other catalyst, according to the equation, $CO + H_2O = CO_2 + H_2$ to the gases undergoing reaction is added the vapour of sodium or potassium hydroxide or of another suitable compound of an alkali metal. (*b*) In the synthesis of ammonia by the interation of hydrogen and nitrogen at high temperatures and pressure in presence of an iron or other catalyst, the vapour of sodium or potassium hydroxide is added to the hydrogen-nitrogen mixture, preferably in amount such that its partial pressure is equal to or greater than the vapour pressure of sodium or potassium hydroxide at the temperature employed for the synthesis. (*c*) For the manufacture of hydrogen by the alternate reduction of iron oxide by a reducing gas and oxidation by steam, air-reducing gas is employed, and/or steam containing the vapour of an alkaline hydroxide or oxide as already specified.

CELLULOSE ACETATE, IMPROVEMENTS IN SOLUTIONS OF. 127,027. J. Huebner, Municipal School of Technology, Manchester.

In the manufacture of solutions of cellulose acetates, the use as a solvent of acetic acid or formic acid, or a mixture of such solvents and other solvents, in conjunction with ethyl or methyl alcohol, or the like, and water.

SULPHURIC ACID, IMPROVEMENTS IN MANUFACTURE OF. 127,047. G. Taylor, Silverwood Colliery, Rotherham, and E. Kilburn Scott, Farningham, Kent.

In the manufacture of sulphuric acid by the chamber process the production of air-borne oxides of nitrogen to act as catalytic agents, by the passage of the air supply to the pyrites burners, or the air containing sulphur dioxide from the burners, through flame arcs or other approved means such as a "Kilburn Scott" 3-phase alternating current electric furnace.

AMMONIA, PROCESS FOR PRODUCING. 127,063 and 127,064. I. W. Cederberg, H. L. Backström, and G. A. Khylberger, Stockholm.

A process for the synthetic production of ammonia from its elements consisting in subjecting a suitable mixture of nitrogen and hydrogen under pressure exceeding 250 atmospheres and at a temperature below 400 deg.C. to the influence of a heated catalyst containing at least one metal beloging to the second subgroups of the main groups I–V of the periodic system, viz., copper, silver, gold, zinc, cadmium, mercury, gallium, indium, thallium, germanium, tin, lead, arsenic, antimony, and bismuth. Also a process similar to the above but in which the ammonia is obtained by passing the hydrogen and nitrogen *alternately* over the catalyst.

BLACK SULPHUR COLOURS, MANUFACTURE OF. 127,143. Brotherton & Co., E. F. Erhardt, and W. W. Kay, the Mersey Chemical Works, New Ferry, Cheshire.

The inventors have found that useful black sulphur colouring can be obtained by melting with sulphur and sodium sulphide a mixture containing an azo dye from diazotised picramic acid and a cresol, and free cresol.

REFINING OILS, IMPROVEMENTS IN. 127,159. The Twitchell Process Company, Cincinnati.

More particularly the invention is concerned with that stage of the refining process in which the oils are treated with sulphuric acid in order to remove unsaturated hydrocarbons. According to the previously known methods of oil refining it has been customary to treat the oils subsequent to their distillation with concentrated or fuming sulphuric acid. After such treatment, the body of mixed oil and acid is allowed to remain quiescent until a separation takes place, the purified oil slowly forming an upper stratum or layer, and the acid sludge settling to the bottom as a lower layer. When the stratification takes place the acid sludge may be drawn off, or the oil may be decanted, whereby a primary separation is effected. It is found, however, that the upper layer, *i.e.*, the refined oil, contains a perceptible and objectionable percentage of sulfo-acids, which must be removed before the oil is suited for ordinary commercial use, and it is with the removal of these dissolved sulfo-acids that the invention is concerned. The improvement consists of the following steps:—(1) Treating the oil with concentrated sulphuric acid; (2) effecting a primary separation by drawing off the acid sludge; (3) neutralizing the dissolved sulpho-acids, as by treatment with an alkali, alkaline earth or other reagent having a basic reaction; for instance, sodium hydroxide or carbonate milk of lime, &c.; (4) extracting the resultant alkali salts of the sulfo-acid with a dilute solution of a solvent, such as alcohol or acetone.

SODIUM NITRATE, IMPROVED MANUFACTURE OF. 127,183. J. Grayson, 22, Cobcroft Road, Huddersfield. *See illustration.*

The invention relates to the manufacture of sodium nitrate and consists in the reduction of nitrous fumes and nitric acid to nitric oxide by the action of sulphur dioxide, purifying the nitric oxide by washing first with water, finally with a dilute solution of soda ash, then admitting air until the nitrogen oxides have approximately the empirical composition N_2O_3, and absorbing these fumes in a concentrated solution of soda ash, caustic soda, and adding more solid ash as the reaction progresses, so obtaining a concentrated solution of sodium nitrate free from sodium nitrate. As seen from the illustration, there is a retort in which sulphur dioxide is generated. Nitric acid is produced in a second retort by the action of sulphuric acid on sodium nitrate. A current of sulphur dioxide is led into this retort and the resulting gases are passed through a condenser to condense the sulphuric acid formed. This acid is collected in a trap and a portion of it is allowed to pass to a tank for supplying the retorts. The gases now pass through an earthenware tower packed with brick and supplied with water. This acts as a scrubber to remove most of the sulphur dioxide and sulphur trioxide, and completes the reduction of the nitrous fumes. After this operation the gases pass through a pipe to a similar scrubber containing a dilute solution of soda ash which removes any remaining sulphur dioxide. After leaving the scrubber the gases pass through a pipe containing two sight glasses and an air inlet valve interposed between them. As the gases reach the upper sight glass they are found to be colourless and air is admitted through a valve to transform slightly less than half of the nitric oxide to nitrogen peroxide, the colour of which is seen in the lower sight glass The gases are then led to a scrubber containing a saturated solution of soda ash, by which they are absorbed.

2–AMINOANTHRAQUINONE, A PROCESS FOR MAKING. 127,223. J. R. Geigy, 3, Bahnhofstrasse, Basle.

A process of manufacture of 2-aminoanthraquinone consisting in heating under pressure anthraquinone-2-sulphonic acid with ammonia in the presence of chloride of calcium with the addition of chloride of ammonium, chloride of sodium, chloride of magnesium or mixtures thereof.

We have received from Longmans, Green & Co., a copy of "The Metals of the Rare Earths," by J. F. Spencer (pp. 279, 12s. 6d.), in their series, "Monographs on Inorganic and Physical Chemistry."

Messrs. Adam Hilger, Ltd., makers of astronomical and optical instruments, have sent us a complete set of the publications emanating from their Research Department. These include a valuable set of tables of refractive indices of essential oil, running to 145 pages; two booklets on a simplified method of tracing rays through any optical system; and on the elements of the electro-magnetic theory of light. In addition, there are a number of pamphlets of a theoretical nature, dealing with refractometry and optical theory.

The Commissioners of the Treasury have appointed a Standing Committee to inquire into the financial needs of Universities in the United Kingdom, and to advise the Government as to the application of Parliamentary grants for their assistance. The first members of what will be known as the University Grand Committee are Sir William M'Cormick (Chairman), Professor William Bateson, Sir Dugald Clerk, Sir J. J. Dobbie, Miss S. M. Fry, Sir F. G. Kenyon, Sir Stanley Leathes, Sir William Caler, and Sir J. J. Thomson.

The second number of *Surplus*, the official organ of the Surplus Government Property Disposal Board, Ministry of Munitions, has just appeared. Its publication was delayed for a few days owing to the enormous pressure on the Stationery Office, due to the printing of the prospectus of the Victory War Loan. Issued bi-monthly, the aim of the publication is to provide detailed particulars of the immense surplus war stores which have become available for sale. New features have been introduced in this issue, and there are over 30 additional pages. *Surplus* keeps manufacturers and traders acquainted with the particular line of goods in which they are interested, and is on sale at all bookstalls and newsagents at the price of 3d.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co. and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. Only commodities whose values are at the time of particular interest or of a fluctuating nature are included in our weekly report. A more complete list and report, including a Continental and American report, will appear in the first issue of each month, commencing on July 5, and will also include prices of plant supplies, building materials, structural steel, fuels, glues, ores, refractories, metals, minerals, and miscellaneous materials, as soon as the necessary arrangements are completed. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report. Suggestions and criticisms in regard to these pages will be welcomed.*

Market Report

THURSDAY, June 26, 1919.

BUSINESS has shown decided activity during this week, the marked feature being the sustained nature of the export demand. The temporary stoppage in the cotton trade does not appear to have affected trade in the North to any extent, although buying still proceeds along somewhat restricted lines.

There are no marked features to report, while again there is very little movement in the prevailing level of values. Stocks of some products are of very narrow dimensions. Although the forward position is still uncertain, the general tone can be described as healthy under existing circumstances.

General Chemicals

ACETONE.—The consumption is showing signs of reviving and important deliveries have been made from stock. The price seems likely to remain unchanged.

ACID ACETIC.—Shipments from America are coming forward slowly, and stocks here are being rapidly depleted. There has been considerable enquiry for pure for edible purposes, and the spot price has slightly improved

ACID CITRIC.—The increased cost of citrate of lime is compelling manufacturers to hold out for higher prices for citric.

An important demand is expected from the Central Empires in the near future, and an advance in price may therefore be expected.

ACID OXALIC.—The position is much firmer, and the makers have no difficulty in making sales at the present market quotations.

ACID TARTARIC.—Several important sales have been made from Italy for forward delivery, and the prospects for this article are undoubtedly brighter. Based upon the present cost of raw material, to-day's quotation for acid is reasonably low.

AMMONIA CARBONATE.—There has been a small increased demand for this material mainly on export account.

ARSENIC.—A welcome improvement in the position is already noticeable, and there are indications of a gradual recovery taking place.

BARIUM SALTS.—Prices are still inclined to be easy for Barium products and the market favours buyers.

BLEACHING POWDER.—Exporters are taking advantage of the present favourable opportunity for making purchases, and we expect that the large stocks in makers' hands will shortly be considerably reduced.

COPPER SULPHATE.—Although there have been one or two transactions arranged for fairly large quantities, business is still inactive; the undertone however, is quite firm.

LEAD ACETATE.—The demand is slowly improving, although the price remains on a high level.

LITHOPONE.—Business is still active in this product.

POTASH CARBONATE.—Some large parcels have been taken off the market, and it is difficult to purchase for spot delivery below the present market quotations.

SODA CAUSTIC.—Although the consumption has not increased to any appreciable extent, the export demand is making up for the deficiency, and there does not appear to be any accumulation of stock at makers' works.

SODA PRUSSIATE.—Slightly more enquiry has been noticed, but the market is very easy.

SODIUM HYDROSULPHITE.—This product—which was formerly a German monopoly—is manufactured on a large scale in England, and is obtainable at a moderately low price.

SODIUM HYPOSULPHITE.—The output will probably be smaller than was anticipated during the second half of this year, whereas the demand may improve owing to the better outlook in the tanning trade.

SODIUM PHOSPHATE.—Moderate business has been transacted, and it looks as though we have touched the bottom value on this product for the moment.

WHITE LEAD.—A considerable volume of business has been transacted for forward delivery at the present quotations, and all manufacturers are heavily engaged.

Heavy Coal Tar Products

There is no change in the market generally.

BENZOL is still in good demand for the home trade, with occasional transactions for export at 1s. 9d. and 1s. 10d. per gallon.

CREOSOTE.—There is a good demand for Creosote Oil for fuel purposes, and prices are well maintained at 5d. to 6d. per gallon according to quality.

CRESYLIC ACID is in moderate demand at 2s. 6d. to 2s. 7½d. per gallon for the 95 per cent. and 2s. 9d. to 3s. per gallon for the 97–99 per cent., f.o.b. in barrels.

NAPHTHALENE is quiet and unchanged in price.

PITCH.—There is some demand for next season's shipment, and business has been done at 60s. f.o.b. East Coast, while some makers ask 70s. to 72s. 6d. f.o.b. London.

SOLVENT NAPHTHA is still slow of sale without change in price, namely 1s. 9d. to 2s. in the North, and 2s. to 2s. 1d. in London.

Sulphate of Ammonia

There is a fair demand for export, both for prompt and for shipment up to the end of the year, at prices varying from £21 10s. to £32, f.o.b., according to destination.

Coal Tar Intermediates

ANTHRANILIC ACID.—Interest seems to be developing for the American product, and a fair business has been done at current rates.

ANTHARCENE.—Supplies of the higher strength, 80–95 per cent. still remain negligible. Makers being still content to market the lower grades 40–45 per cent.

BETANAPHTHOL.—The demand continues steady and there is no apparent shortage of supplies. On the whole the market shows a slightly weaker tendency.

ORTHOAMIDO PHENOL.—Satisfactory developments have been made by British makers and reliable products are now obtainable at lower prices.

TECHNICAL RESORCIN.—The probable drop in price forecasted in our last issue has taken place, owing to Continental makes which are now offered against the American imported product. The quality is superior to the American.

Current Prices

Chemicals.

June 26th, 1919.

	per	£	s.	d.		£	s.	d.
Acetic anhydride	lb.	0	3	6	to	0	3	9
Acetone, pure	ton	95	0	0	to	97	0	0
Acid, Acetic, glacial, 99-100%	ton	77	10	0	to	80	0	0
Acetic, 80% pure	ton	62	10	0	to	65	0	0
Citric	lb.	0	4	4	to	0	4	5
Lactic, 50% vol.	ton	70	0	0	to	72	10	0
Lactic, 60% vol.	ton	85	0	0	to	87	10	0
Oxalic	lb.	0	1	2½	to	0	1	3
Pyrogallic cryst.	lb.	0	10	6	to	0	11	0
Tannic, coml.	lb.	0	2	9	to	0	3	0
Tartaric	lb.	0	3	3	to	0	3	4
Alum, lump	ton	17	15	0	to	18	0	0
Aluminium sulphate, 14-15%	ton	13	10	0	to	14	0	0
Aluminium sulphate, 17-18%	ton	17	0	0	to	17	10	0
Ammonia, anhydrous	lb.	0	1	9	to	0	2	0
.880	ton	32	10	0	to	37	10	0
Carbonate	lb.	0	0	6½				
Muriate	ton	48	0	0	to	50	0	0
Nitrate	ton	55	0	0	to	60	0	0
Phosphate	ton	110	0	0				
Arsenic, white 99-100%	ton	38	0	0	to	39	0	0
Barium, Carbonate, 92-94%	ton	11	10	0	to	12	0	0
Chloride	ton	27	0	0	to	27	10	0
Nitrate	ton	51	0	0	to	52	0	0
Sulphate, (blanc fixe) pulp	ton	15	10	0	to	16	0	0
Sulphate, (blanc fixe) dry	ton	25	10	0	to	26	0	0
Bleaching powder, 35-37%	ton	13	10	0	to	14	0	0
Borax crystals	ton	39	0	0	to	39	10	0
Calcium acetate, grey	ton	16	0	0	to	16	10	0
Calcium chloride	ton	8	10	0	to	9	0	0
Cobalt oxide, black	lb.	0	7	9	to	0	8	0
Copper sulphate	ton	45	0	0	to	47	0	0
Cream Tartar, 98-100%	ton	215	0	0	to	220	0	0
Epsom Salts (see Magnesium Sulphate).								
Formusol (Rangalite)	lb.	0	4	0	to	0	4	3
Iron, perchloride	ton	30	0	0	to	32	0	0
Sulphate (copperas)	ton	5	10	0	to	6	10	0
Lead, Acetate, white	ton	82	10	0	to	85	0	0
Nitrate	ton	58	10	0	to	59	0	0
Lithopone, 30%	ton	42	10	0	to	45	0	0
Magnesium, Chloride	ton	15	0	0	to	16	0	0
Carbonate, light	cwt.	3	0	0	to	3	5	0
Sulphate (Epsom salts, coml.)	ton	11	0	0	to	11	10	0
Magnesium Sulphate (druggist's)	ton	16	10	0	to	18	0	0
Methyl Acetone	ton	89	0	0	to	90	0	0
Methyl Alcohol, 10% Acetone	gall.	0	9	0	to	0	9	6
Potassium, Bichromate	lb.	0	1	6	to	0	1	7
Carbonate, 90%	ton	90	0	0	to	92	10	0
Chlorate	lb.	0	1	3	to	0	1	4
Metabisulphite, 50-52%	ton	200	0	0	to	205	0	0
Nitrate refined	ton	58	0	0	to	60	0	0
Permanganate	lb.	0	3	6	to	0	3	9
Prussiate, yellow	lb.	0	1	9	to	0	1	10
Prussiate, red	lb.	0	6	0	to	0	6	3
Sulphate	ton	37	10	0	to	40	0	0
Sal. Ammoniac, firsts	cwt.	4	0	0				
Sal. Ammoniac, seconds	cwt.	3	15	0				
Sodium Hydrosulphite, powder, 85%	lb.	0	3	3	to	0	3	6
Sodium, Acetate	ton	57	10	0	to	60	0	0
Arseniate, 45%	ton	47	0	0	to	47	10	0
Bicarbonate	ton	9	0	0	to	9	10	0
Bisulphite, 60-62%	ton	28	0	0	to	29	0	0
Chlorate	lb.	0	0	8	to	0	0	8½
Caustic, 70%	ton	19	0	0	to	19	10	0
Caustic, 76%	ton	23	0	0	to	23	10	0
Hyposulphite, coml.	ton	17	0	0	to	17	10	0
Nitrite, 96-98%	ton	60	0	0	to	62	10	0
Phosphate cryst.	ton	25	0	0	to	25	10	0
Prussiate	lb.	0	0	8	to	0	0	8½
Sulphide, cryst.	ton	15	10	0	to	16	0	0
Sulphide, solid, 60-62%	ton	21	10	0	to	24	0	0
Sulphite, cryst.	ton	11	0	0	to	11	10	0
Strontium, Carbonate	ton	55	0	0				
„ Sulphate, white	ton	11	10	0	to	12	10	0
Sulphur, chloride	ton	38	0	0	to	40	0	0
Tin perchloride, 33%	lb.	0	2	4	to	0	2	5
Protochloride (tin crystals)	lb.	0	1	8	to	0	1	9
Zinc, chloride, 102 Tw.	ton	22	0	0	to	24	0	0
Chloride, solid, 96-98%	ton	62	0	0	to	62	10	0
Sulphate	ton	21	10	0	to	23	0	0

Coal Tar Intermediates, &c.

	per	£	s.	d.		£	s.	d.
Alphanaphthol, crude	lb.	0	3	0	to	0	3	6
Alphanaphthol, refined	lb.	0	3	6	to	0	4	0
Alphanaphthylamine	lb.	0	2	6	to	0	2	9
Aniline oil, drums free	lb.	0	1	2	to	0	1	3
Aniline salts	lb.	0	1	3½	to	0	1	4
Anthracene, 80%	lb.	0	2	6	to	0	2	9
Anthranilic Acid	lb.	1	12	0	to	1	13	0
Benzaldehyde (free of chlorine,	lb.	0	9	0	to	0	9	6
Benzidine, base	lb.	0	5	6	to	0	6	0
Benzidine, sulphate	lb.	0	4	9	to	0	5	0
Benzoic, acid	lb.	0	4	9	to	0	5	0
Benzoate of soda	lb.	0	4	6	to	0	4	9
Benzyl chloride, technical	lb.	0	1	9	to	0	2	0
Betanaphthol benzoate	lb.	1	5	0	to	1	7	6
Betanaphthol	lb.	0	2	3	to	0	2	6
Betanaphthylamine technical	lb.	0	6	6	to	0	7	0
Dichlorbenzol	lb.	0	0	5	to	0	0	6
Diethylaniline	lb.	0	7	0	to	0	8	0
Dinitrobenzol	lb.	0	1	4	to	0	1	6
Dinitrochlorbenzol	lb.	0	1	2	to	0	1	3
Dinitronaphthaline	lb.	0	2	0	to	0	2	3
Dinitrotoluol	lb.	0	1	10	to	0	2	0
Dinitrophenol	lb.	0	1	10	to	0	2	0
Dimethylaniline	lb.	0	2	9	to	0	3	0
Diphenylamine	lb.	0	3	0	to	0	3	3
H-Acid	lb.	0	7	6	to	0	8	0
Metaphenyleanediamine	lb.	0	4	6	to	0	4	9
Monochlorbenzol	lb.	0	0	9	to	0	0	10
Naphthionic acid, crude	lb.	0	3	6	to	0	3	9
Naphthylamin-di-sulphonic acid	lb.	0	4	6	to	0	5	0
Nitronaphthaline	lb.	0	1	2	to	0	1	6
Nitrotoluol	lb.	0	1	3	to	0	1	6
Orthoamidophenol	lb.	0	15	0	to	0	16	0
Orthodichlorbenzol	lb.	0	1	1	to	0	1	3
Orthotoluidine	lb.	0	2	0	to	0	2	3
Orthonitrotoluol	lb.	0	1	6	to	0	1	9
Para-amidophenol, base	lb.	0	13	0	to	0	14	0
Para-amidophenol, hydrochlor	lb.	0	15	6	to	0	16	0
Paradichlorbenzol	lb.	0	0	4	to	0	0	5
Paranitraniline	lb.	0	3	9	to	0	4	0
Paranitrotoluol	lb.	0	5	3	to	0	5	6
Paraphenylenediamine, distilled	lb.	0	15	0	to	0	16	0
Paratoluidine	lb.	0	7	0	to	0	7	6
Phthalic, anhydride	lb.	0	14	0	to	0	15	0
Resorcin, technical	lb.	0	10	0	to	0	11	0
Resorcin, pure	lb.	0	15	0	to	0	16	0
Salicylic acid	lb.	0	1	9	to	0	1	10
Salol	lb.	0	3	9	to	0	4	0
Sulphanilic acid, crude	lb.	0	1	0	to	0	1	3
Toluidine, base	lb.	0	9	0	to	0	10	0
Toluidine, mixture	lb.	0	2	9	to	0	3	0

American Chemical Industry

Mr. Joseph Choate, representing the United States Chemical Foundation, has filed a brief with the Ways and Means Committee of the House of Representatives, pleading that Congress enact legislation to protect the American chemical and dye industry from German attempts to regain their former monopoly. The brief points out that America before the war was at the mercy of Germany with respect to her supplies of dye stuffs; and quotes Count Bernstorff's despatch to his Government, stating that the stock of dyes in America was so small that a German embargo against the United States would throw four million American workmen out of employment. The ease with which dye works can be transformed into high explosive factories is also urged as a reason for protecting the chemical industry in America.

Government Oil Committee

On the Ministry of Munitions Vote in the House of Commons, on Tuesday evening, Mr. Stanley Holmes pressed upon the Government the necessity of settling as soon as possible the contest which had arisen over the question of the ownership of the oil in Derbyshire. Mr. James Hope, in reply, said it was intended that the oil discovered in Derbyshire should be refined in Scotland. The Government, as a whole, were considering the question of policy arising out of the discovery, and were about to appoint a strong Committee to deal with the matter.

In reply to Commander Bellairs, who asked the Parliamentary Secretary to the Ministry of Munitions whether the oil found in Derbyshire is of a kind that could be used in the internal-combustion engines of ships, Mr. Kellaway stated that the oil could not be safely used for such a purpose in a crude state, but a certain proportion of the refined products should be quite suitable for internal-combustion engines afloat. The exact percentage would depend on the whole refining arrangements and the various grades of oil which it was desired to manufacture.

Company News

OIL TRUST.—The directors announce that the recent issue to the shareholders of 700,000 shares at par has been largely over-subscribed.

MINERALS SEPARATION.—Interim dividend at the rate of 5s. per share, or 25 per cent., less income tax, for the year ending December 31, payable on July 25, the same as a year ago.

BRITISH MALAY RUBBER.—The profits for 1918 amounted to £9,179, against £14,696. The directors recommend the payment of a dividend of 10 per cent., the same as for 1917; leaving £2,915, against £6,736, to be carried forward.

LOBITOS OILFIELDS.—The Lobitos Oilfields Company announce a dividend of 15 per cent. for 1918. This is equal to the highest yet paid by the company, and compares with 5 per cent. for 1917 and 10 per cent. for 1916. It is also proposed to place £30,000 to reserve account, which compares with £10,000 a year ago, and to carry forward £36,546, against £59,709.

AMALGAMATED ZINC (DE BAVAY'S).—The accounts for the half-year ended December 31 show an available balance of £32,913, which, with the amount brought forward from the previous half-year, makes £48,058 available for distribution. A dividend of 5 per cent. (1s. per share) was paid in December last, making 20 per cent. for the year; while £8,604 has been transferred to depreciation reserve and £14,454 carried forward.

MUNTZ'S METAL COMPANY.—After delays, due to the inability of the Inland Revenue authorities to settle the question of war taxation, the directors of Muntz's Metal Company, of Birmingham, are enabled to present the accounts for 1917 and 1918. Dividends of 10 per cent. on the ordinary shares have been paid for both years; and while for 1917 £10,000 was added to the reserve, for 1918 the allocation was £12,000, making the fund £65,000. Last year the net profit rose from £24,611 to £30,085, and the available balance from £32,377 to £37,187. The carry-forward will be increased from £7,102 to £9,911.

SYNTHETIC COAL SYNDICATE.—The petition of Vickery, Hunt & Co. for the compulsory winding up of the Synthetic Coal Syndicate, Ltd., was allowed by Mr. Justice Lawrence, on Tuesday, to stand over for a fortnight. Mr. Owen Thompson, K.C., said that negotiations were pending for the payment of not only the petitioning creditor, but all the creditors. The petitioner was a judgment creditor. His Lordship said the advertisement had not been in the usual form, and he ordered the petition to be re-advertised and the petition to stand over for two weeks.

ALUMINIUM CORPORATION.—The directors having not yet arrived at a complete settlement with the Inland Revenue authorities in respect of the company's liabilities for excess profits duty, are not in a position to submit the accounts for the year to December 31 last. It is anticipated that they will be able to present the accounts not later than the autumn, and the chairman's statement will be postponed until then. The directors are satisfied that the results of the year's trading justifies them in recommending payment of preference dividend for the year 1918. Meeting, Great Eastern Railway Hotel, Liverpool Street, June 30, at 12.30.

ELECTRO BLEACH AND BY-PRODUCTS.—The profit of the Electro-Bleach and By-Products for 1918, after deducting for depreciation, directors' additional remuneration and excess profits duty, amounted to £24,498, against £25,902. After charging debenture interest and sinking fund and the interim dividend of 3½ per cent. on the Preference shares, the available balance was £16,094, against £17,870. Of this sum, £11,700 was required to pay the further interim dividends (on account of 1918) on the Preference shares, making 7 per cent. for the year; and of 12½ per cent. on the Ordinary shares, against 10 per cent. The directors recommend that £4,000 be placed to reserve account, against £6,000; and that £394 be carried forward, against £1,076. The Inland Revenue Department has allowed the company to appropriate out of revenue the sum of £10,000 for deferred repairs.

BURMAH OIL COMPANY.—The profits of the Burmah Oil Company for the year to December 31 last amounted to £2,814,058, against £2,776,968. Depreciation absorbs £491,020, against £471,838; and with the addition of the balance (after payment of excess profits duty) brought forward from 1917, £148,867, there is available £2,962,924. As last year, £80,000 has been transferred to fields reserve and £20,000 to insurance reserve, while general reserve is credited with £186,695, against £200,000. The directors recommend a final dividend on the Ordinary shares of 5s. per share, free of tax, leaving to be carried forward, £1,776,220 (subject to excess profits duty, estimated at £1,580,000), against £1,383,977. The final dividend of 5s. per share, with the interim payment, makes a distribution of 30 per cent. on the Ordinary shares for the year, against 32½ per cent. for 1917.

SOUTH YORKSHIRE CHEMICAL WORKS.—The South Yorkshire Chemical Works, Ltd., has been registered with a nominal capital of £350,000 in £1 shares (200,000 preference). The objects are to acquire the business of an owner of chemical and by-products works carried on by Earl Fitzwilliam at Parkgate, near Rotherham, and to carry on the business of owners of gas plants, manufacturers of and dealers in gas plants, coke, peat, sulphate of ammonia, pitch, tar, toluol, breeze, creosote, slack, naphtha, naphthalene and asphaltum, ammonia, dyes, colours, explosives, coke ovens, gas, chemicals of all kinds, and residual or by-products, &c. The first directors are Earl Fitzwilliam (chairman), Sir E. W. D. Ward (vice-chairman), Mr. E. C. Ward, Mr. H. St. J. Durnford, and Mr. A. Hutchings.

LAGUNAS NITRATE COMPANY.—At the general meeting, Mr. R. E. Morris said that the decrease in the trading profits, which were £40,653 last year, as compared with £60,625 in the preceding year, was due to the fact that on December 31 they were carrying unusually large stocks of nitrate, some 136,000 quintals, of which, however, 80,000 quintals had at that time been sold but not delivered. The value of this nitrate had now been received and the net profit realised was over £16,000. They had been unable, as yet, to market the November and December production, but the shareholders would reap the benefit of this during the current year. Notwithstanding the restriction placed on dealings by the Nitrate Executive appointed by the Allied Governments, in order that they might dispose of the large stocks they had on hand at the cessation of hostilities, some of the producers had continued to work, and to-day there were over 30,000,000 quintals of nitrate in Chile.

BRUNNER, MOND, & CO.—At the annual meeting the following dividends for the year ended March 31st, were declared: To the holders of preference shares at the rate of 7 per cent. per annum, less income tax, and less the interim dividend paid in December; and to the holders of ordinary shares at the rate of 10 per cent. per annum, less income tax, and less the interim dividend. The profit balance for the year was (including £117,072 brought forward), £1,129,153. Mr. J. F. L. Brunner, Mr. H. Glendinning, and Mr. Robert Mond were re-elected directors, while the seven new members of the board—namely, Messrs. J. H. Gold, J. J. Harper, J. G. Nicholson, Lt.-Colonel G. P. Pollitt, Mr. C. F. Poole, Mr. Louis Solvay, and Mr. A. W. Tangye—were re-elected directors. It was decided that each of the directors, other than the managing directors, be paid at the rate of £500 per annum, and that the capital of the company be increased to £15,000,000 by the creation of new shares.

"SHELL" TRANSPORT AND TRADING COMPANY.—The report for the year ended December 31 last states that, including the balance—£1,239,032 brought forward from 1917—there is a credit to the profit and loss account of £4,132,635. Management, interest, legal and other expenses and depreciation on securities absorb £40,658, leaving £4,091,976. After deducting Preference and interim dividends and placing £41,172 to reserve, there remains a balance of £3,146,825, from which the directors declare a final dividend of 5s. per share, making 35 per cent. for the year; leaving £1,136,877 to be carried forward. The aggregate insurance funds of the Bataafsche Petroleum Maatscheppij amount to 49,000,000 guilders (£4,083,333). Reports received from the Anglo-Saxon Petroleum Company, Ltd., and the Bataafsche Petroleum Maatschappij enable the directors to assure the shareholders of the continued prosperity of the business. The representation of the company on the boards of the Anglo-Saxon Petroleum Company, Ltd., and the Bataafsche Petroleum Maatschappij remains unaltered.

ENGLISH OILFIELDS, LTD.—Dealings are now taking place in the shares of English Oilfields, Ltd., a company with an authorised capital of £300,000 in 300,000 shares of £1 each, all issued, and of which 150,000 shares are vendors' shares. The company states that it owns full mineral rights over selected oil shale bearing lands, having a total area of over 20 square miles, situate in Norfolk in the neighbourhood of the port of King's Lynn. The property has been examined and reported upon by Dr. W. Forbes-Leslie, F.G.S., and Mr. Renwick Cowan, who both anticipate the successful development of this undertaking. It is intended to establish a number of subsidiary undertakings to operate selected areas of ground under the parent company's auspices, the capital of the latter (£300,000) being comparatively small and insufficient for the operations justified by the prospects. Each such subsidiary will be equipped with a plant for treating not less than 1,000 tons of shale per day such plants being designed from the initial unit erected by the company. Large extra profits are expected from this source.

PREMIER OIL AND PIPE RECONSTRUCTION.—The directors have drawn up a scheme of reconstruction which they will shortly bring before the shareholders. The proposal necessitates the voluntary liquidation of the present company and the formation of a new one with a capital of £3,750,000 divided into 5,000,000 shares of 15s. each. Of these shares, 4,263,555 will be allotted to the shareholders of the old company credited with 14s. paid up, which really means an assessment of 1s. per share, each Preference holder in the present company receiving three new shares for every two held and each Ordinary shareholder one for each one held. The balance of 736,445 shares will be available for future issue on terms which will obviously depend upon the amount of success which the new company achieves. The directors have information that the Poles favour the advent of British new capital into the Galician petroleum industry, and it is believed that the new funds which will accrue to the new Premier Company will be sufficient to not only repair the damage done during enemy occupation (which was comparatively slight, apart from the destruction of one of the four of their refineries), but to take advantage of opportunities which will present themselves for the company's commercial expansion.

The Royal Society

At a meeting of the Royal Society in London on Thursday a paper on "Experiments with Perforated Electrodes on the Nature of the Discharge in Gases at Low Pressures." Mr. F. W. Aston, M.A., D.Sc., Clerk Maxwell Student of the University of Cambridge, was read.

In the paper experiments were described on the discharge between electrodes of a large flat form perforated with a long narrow slit, the charge passing through the slit being collected and measured in a Faraday cylinder. Direct measurements made with the Faraday cylinder behind the cathode, and at the same potential seem to indicate that about half the total current in the discharge is brought up to the cathode by positive ions. Attempts to discover the distribution of velocities in this stream show that this is not directly determinable, owing to the very high ionisation in the region of the slit and other reasons, which are discussed. Using a perforated anode, it is found that as the distance from the cathode is increased arithmetically the current carried by the cathode rays into the Faraday cylinder decreases geometrically when the current is constant. The effect of (*a*) the distance apart of the electrodes and (*b*) the total current flowing, on the disappearance of the last trace of the positive column or Anode Glow is shown to be remarkably definite, but no adequate explanation of this phenomenon seems available at present.

At the ordinary meeting last week, Sir J. J. Thomson in the chair, the Bakerian Lecture was delivered by the Hon. R. J. Strutt, F.R.S., on "A Study of the Line Spectrum of Sodium as Excited by Fluorescence."

An improved form of sodium vapour lamp, in quartz, was described, giving an intensely bright sodium spectrum, admirably adapted for exciting sodium vapour to resonance. It is found that excitation of sodium vapour by the second line of the principal series leads to the emission of both $\lambda 3303$ and the D line. On the other hand, as might be expected, excitation by the D line leads to the emission of the D line only, without 3303. If only one of the components of the doublet 3303 is stimulated, both the D lines are emitted. When D light falls on sodium vapour of appropriate density, it is known than an intense surface emission occurs from the front layer, and a weaker one from succeeding layers. Analysis by absorption in an independent layer of sodium vapour shows that the superficial emission is more absorbable, and therefore nearer the centre of the D lines. The breadth of the D lines in superficial resonance has been estimated by interferometer methods. It is found to correspond with the breadth conditioned by the Doppler effect, calculated on the assumption that the luminous centre is the sodium atom. Polarisation could not be detected in the ultra-violet resonance radiation; though, in accordance with previous observers, it was readily observed in D resonance.

San Sebastian Nitrate

Discussing the general outlook at the annual general meeting of the San Sebastian Nitrate Co., Ltd., this week, the chairman (Mr. H. W. Sillem) made some interesting statements respecting the Government and the shipment of nitrate.

There has (he said) been no event of importance during the year in the working of the property. Work has proceeded smoothly on the whole, and the plant and machinery have given satisfactory results. The grounds have yielded material of fair quality, but no rich deposits, such as we were fortunate enough to find in 1916, were discovered in 1918. The outstanding feature of the nitrate business is that at the signing of the Armistice in November last, the demand for our production at once ceased, no further supplies being required for munitions purposes by the Allied Governments. Since that time only very small shipments for private purposes have been permitted, and the consequence is that there is now a stock of nearly 1,500,000 tons of nitrate on the coast. All British companies were Government controlled up to the 15th of last month, but the removal of control has made no appreciable difference to us, as no shipping is yet available for our particular industry. The Government will not issue licences for the transport of nitrate cargoes until the more urgent needs, as they consider them, of foodstuffs, timber, and certain other essential articles have been attended to.

This situation is an unsatisfactory one from our point of view, and, personally, I am disposed to think that it is not advantageous from a wider point of view. The production of foodstuffs in Europe depends to a great extent on the supply of chemical fertilisers, and it seems to me that it would be cheaper in the end actually to produce food on this side rather than to ship it from America and elsewhere. The official attitude is that as nitrate cannot be used on the land until early next year, there is no need to ship it away from Chile now. This is a mistaken view, however. If nitrate is to be available in inland stations in Europe and elsewhere next season, transport should begin at once. Neither the works, railways, nor ports in Chile are designed to meet a large and sudden demand, nor are transport facilities in Europe, or anywhere else for that matter, so well organised at the present time that the supply of fertilisers can be postponed until actual consumption is due.

You will understand from these remarks that we have a difficult situation to deal with. We are doing our best to carry on the business of the company to advantage, but circumstances arising out of the war, and over which we have no control, are against us at the moment. It is for this reason that the financial policy I referred to has been adopted, and I think you will agree that it is more than justified, particularly in view of the fact that we ceased manufacture of nitrate in January of this year, as we came to the conclusion that it is useless to accumulate stocks for which there is no outlet, and the production of which implies the locking up of considerable sums of borrowed money. We are hopeful that an improvement in the position will take place before long, but it has to be admitted that the inadequacy of tonnage for existing world's requirements is bound to create many difficulties for us. I can only hope that by the time we meet next year they will have become matters of history, instead of being current problems as they are to-day.

Marketing of Sulphate of Ammonia

The Board of Agriculture and Fisheries, in conjunction with the Board of Agriculture for Scotland (a writer in the *Colliery Guardian* states) have consulted the Equalisation Committee of the Sulphate of Ammonia Makers, as representing the manufacturers with a view to making a voluntary arrangement as to prices and distribution in the season extending from June 1st, 1919, to May 31st, 1920. The Agricultural Departments have agreed to the following arrangements in regard to price for the four months June 1st to September 30th, 1919:—

(*a*) The price for sulphate containing 24½ per cent. by weight of ammonia during the period from June 1st to September 30th, 1919, for delivery to manure mixers and makers of compound fertilisers shall not exceed £19 10s. per ton (less a trade discount of 10s. per ton), delivered to purchaser's nearest railway station or wharf in Great Britain, or f.o.b. port in Great Britain for Ireland and the Isle of Man, provided that in the event of the price of sulphate for delivery during the period October 1st, 1919, to June 30th, 1920, being subsequently agreed at a less sum than £19 10s. per ton, a rebate will be made on all such sales so as to reduce the price per ton actually charged to such lesser sum, but so that the rebate shall not in any case exceed £2 10s. per ton. The total quantity sold at this price not to exceed 35,000 tons, for delivery in equal monthly quantities, June to September, 1919.

(*b*) The price for sulphate containing 24½ per cent. by weight of ammonia to agricultural merchants and dealers and co-operative societies for sale to farmers, or to farmers direct, for direct and immediate application to the land, during the period June 1st to September 30th, 1919, shall not exceed £17 per ton (less a trade discount when sold through merchants, dealers and societies of 10s. per ton), delivered to consumer's nearest railway station or wharf (in Great Britain and f.o.b. port in Great Britain for Ireland), the total quantity to be supplied at this price not to exceed 5,000 tons, for delivery within the above dates in equal monthly quantities. Orders received from manure mixers for sale as above for immediate application to the land, whether direct or in compounds, shall be treated in the same way as agricultural merchants' orders.

(*c*) Orders for delivery at these prices to be sent by buyers to the Sulphate of Ammonia Association, who will allocate them among individual makers at their discretion.

It will be seen from the above that the Equalisation Committee undertakes to reserve a quantity of 40,000 tons for home agriculture in the period June to September, 1919.

Commercial Intelligence

LONDON GAZETTE,

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding Up.

YORKSHIRE VULCANISING COMPANY, LTD.—Mr. Charles Henry Baker, 1, Albion-street, Leeds, accountant and auditor, appointed liquidator with a Committee of Inspection, in the place of Mr. William A. Judge, who was desirous of retiring.

Order Made on Application for Discharge.

HIGGINSON, JAMES, 349, Chapel Street, Salford, and Park Street, Salford, both in Lancs., oil merchant (trading together with Charles Albert Swift as the Safety Oil Syndicate, oil merchants.) Discharge suspended for two years. Bankrupt to be discharged as from May 7, 1921. Date of Order, May 7, 1919.

Companies Winding Up Voluntarily.

MESSINA COPPER EXTENSIONS, LTD.—Francis William Ewart Morgan, 17, Eldon Street, E.C. 2, appointed liquidator. Meeting of the creditors at 17, Eldon Street, London, E.C., on Thursday, June 26, 1919, at three p.m.

REGULUS METAL AND PLUMBING COMPANY, LTD.—Albert Edward Tilley, 8, Staple Inn, Holborn, London, Chartered Accountant, appointed Liquidator. Meeting of creditors at 8, Staple Inn, Holborn, on Monday, June 30, at 12.30 p.m.

THE WOHLE MINERAL OIL PRODUCTS (1910), LTD.—Mr. Edwin Hard, 17, Fenchurch Street, London, Chartered Accountant, appointed liquidator.

WESTINGHOUSE METAL FILAMENT LAMP CO., LTD.—Captain M. L. Crandon Gill, A.C.A., appointed liquidator. Meeting of creditors at 2, Norfolk Street, Strand, London, W.C. 2, on Monday, June 30, at 11.30 a.m.

New Companies Registered.

The following list has been prepared for us by Jordan & Sons, Ltd., company registration agents, 116 and 117, Chancery Lane, London, W.C.:—

CASTLE CHROME TANNING CO., LTD., The Castle Chrome Tannery, Green Street, Northampton. Tanners, leather merchants, &c. Nominal capital £21,000 in 21,000 preference shares of £1, and 20,000 ordinary shares of 1s. each. Directors to be appointed by subscribers. Qualification of Directors, £100. Remuneration of Directors to be voted by company in general meeting.

F. W. COOME, LTD., 8, Arthur Street, E.C.4. Manufacturers and dealers in glue, gum, chemists sundries. Nominal capital £3,000 in 3,000 ordinary shares of £1 each. Directors: F. W. Coombe (Governing Director). Qualification of Directors, £50. Remuneration of Directors to be voted by company in general meeting.

FALCON CHEMICAL & RUBBER CO., LTD., 230, and 232, Produce Exchange, Cathedral Street, Manchester. Nominal capital £5,000 in 5,000 shares of £1 each. Directors: H. J. Jack (Governing Director); G. T. Weller, 8, Craighall Street, Slade Lane, Levenshulme; T. G. Russell, The Cottage, Lees Road, Eranhall, Cheshire. Qualification of Directors £100, £3,000 Governing Director. Remuneration of Directors to be voted by company in general meeting.

FANCY LEATHER GOODS (LIVERPOOL), LTD., 70, Central Buildings, 41, North John Street, Liverpool. Fancy leather goods manufacturer. Nominal capital £2,000 in 2,000 ordinary shares of £1 each. Directors: A. Foster, 34, Catherine Street, Liverpool; W. M. White, "Caldercruix," Moreton, Cheshire; J. R. Wilson, "Westcliffe," Fertram Drive, Liscard, Cheshire. Qualification of Directors £100. Remuneration of Directors to be voted by company in general meeting.

HALLIDAY & CO., LTD., "Bankfield" Dyeworks, Sandy Lane, Stockport, Lancaster. Bleachers, mercerizers, dyers, and finishers. Nominal capital £75,000 in 25,000 preference shares of £1 each, and 50,000 ordinary shares of £1 each. Directors: J. Halliday (Governing Director). Qualification of Directors, £200. £5,000 Governing Director. Remuneration of Directors to be voted by company in general meeting. Governing Director not exceeding £3,000.

HOWARD, STEPHENS & CO., LTD., 20, Highgate Road, N.W.5. Manufacturing chemist, druggist and drysalter. Nominal capital £3,000 in 3,000 shares of £1 each. Directors: T. Howard (Governing Director); Constance M. Howard. Qualification of Directors, 1 share. Remuneration of Directors, £350. Governing Director: C. M. Howard, £50.

PARK GATE IRON & STEEL CO., LTD., Park Gate, nr. Rotherham, Yorks. To purchase, lease or otherwise acquire iron works, steel works, coal mines or any other mines, and carry on the business of miners, smelters, engineers, &c. Nominal capital £1,500,000 in 1,500,000 ordinary shares of £1 each. Minimum subscription 7 shares. Directors: C. P. Markham, Ringwood, Chesterfield; D. Vickers, Temple Dinsley, Hitchin; W. B. M. Bird, Eartham, Chichester; A. Willis-Dixon, Aston Hall, Swallownest, nr. Sheffield; P. W. Fawcett, Whirlow Brook, Parkhead Sheffield. Qualification of Directors, £1,000. Remuneration of Directors, £3,000, to be divided.

S. D. Q. MANUFACTURING CO., LTD., Russell Chambers, King Street, Nottingham. Manufacturing chemists, general manufacturers of compounds, &c. Nominal capital £11,000 in 10,000 8 per cent. cumulative preference shares of £1 each, and 20,000 ordinary shares of 1s. each. Directors to be appointed. Qualification of Directors, 1 share Remuneration of Directors to be voted by company in general meeting.

SOUTH YORKSHIRE CHEMICAL WORKS, LTD., 20, Conduit Street, W.1. Chemical and bye-products works. Nominal capital £350,000 in 350,000 shares of £1 each. Directors: Right Hon. W. C. de Meuron, Earl Fitzwilliam, K.C., V.O., D.S.O. Chairman); Sir E. W. D. Ward, Bart, G.B.E., K.C.B., K.C.V.O. (Vice-Chairman); E. S. Ward; H. St. John Ward; A. Hutchings. Qualification of Directors, £100. Remuneration of Directors £300 each. Chairman £1,000. Vice-Chairman £500.

TAYLOR & EVANS, LTD., 8, Victoria Street, Liverpool. Chemical and colour merchants, &c. Nominal capital £3,000 in 3,000 shares of £1 each. Directors: W. C. Taylor, "Newlands," Fairfield Road, Latchford Without, Warrington; A. L. Evans, Bank House, Huyton. Qualification of Directors, other than first Directors, £25. Remuneration of Directors to be voted by company in general meeting.

TIKAM BATU RUBBER CO., LTD. Nominal capital £50,000 in 500,000 shares of 2s. Minimum subscription, 7 shares. Directors: C. Edwards, 8 Billiter Square, E.C.3.; F. C. Rycroft, Winchester House, Old Broad Street, E.C.2.; G. I. Watson, 86, Cannon Street, E.C.4. Qualification of Directors, £200. Remuneration of Directors, £100 each, Chairman, £150

Bankruptcy Proceedings.

C. T. HOARE.

Cyril Thornton Hoare, 256, Knightsbridge, S.W., who partly attributes his insolvency to his failure to obtain for the inventor a Government contract for the supply of a new varnish, attended at the London Bankruptcy Court, on June 20, for his public examination, upon a statement of affairs showing liabilities £3,059 0s. 1d., of which £1,551 5s. 1d. was expected to rank; and assets, a bad book debt, £40. Examined by the Official Receiver, the debtor said that he was to receive a considerable commission on the varnish transaction. According to his amended statement of affairs, there was a contingent liability of £450 due to a moneylender, contracted in February last, on a promissory note which he and another person had given. At one time two chemical combines took a considerable interest in the possibilities of the new varnish. It appeared that his creditors had accepted a proposal for the payment of a composition of 6s. 3d. in the £, and this will in due course come before the Court for approval.

WALTER JAMES STEVENSON.

The affairs of Walter James Stevenson, Charing Cross Hotel, W.C., who is the inventor of a chemical compound (acetate cellulose) for use in the construction of aeroplane wings, and for making non-inflammable films, came before Mr. Registrar Mellor at the London Bankruptcy Court on June 24th, upon the adjourned hearing of his application to approve a composition of 10s. in the £ to unsecured creditors, which proposal has recently been entertained by the statutory majority of the creditors. Having regard to the fact that no patent had yet been granted in respect of the invention, the Official Receiver considered that the terms of the proposal were reasonable, and calculated to benefit the general body of the creditors. His Honour made an order approving the proposal.

T. J. WALTERSON-WILLIAMS.

Thomas John Walterson-Williams, operative mechanic, Drug Stores, Cwmparc, Treorchy, Glamorgan. The following are creditors: Dental Manufacturing Co., London, £30; Edwards Dental Manufacturing Co., London, £15; Potter & Clarke, Ltd., London, £56; A. & F. Pears, Ltd., London, £17; F. G. Phillips, London, £13; Osborne Garrett & Co., Ltd., Birmingham, £35; Slott Bros., London, £13; Veno Drug Co., Ltd., Manchester, £11; W. G. Young, Treorchy, £84; H. N. Gilbey, London, £8; Lysol, Ltd. London, £8; Roderick Morgan, Treorchy, £9; Turner Chemical Manufacturing Co., London, £8; Tipple, Penygraig, £6; F. Williams, Treorchy, £6; Western Dental Co., Cardiff, £14; Mrs. Richards, Ogmore, £7.

Stocks and Shares

Commercial, Industrial, &c.

	Quotations June 25.
Alby United Carbide Factories, Lim., Ord.	7/8 — 1
Associated Portland Cement Manufrs. (1900.) Lim., Ord.	7 11/16 — 7 15/16
Bell's United Asbestos Co., Lim., Ord.	2 1/8 — 2 3/8
Bleachers' Association, Lim., Ord.	1 9/32 — 1 11/32
Borax Consolidated, Lim., Prefd. Ord.	4 3/8 — 4 7/8
Bradford Dyers' Assoc. Lim., Ord.	2 3/16 — 2 5/16
British Aluminium Co., Lim., Ord.	1 11/16 — 1 13/16
British Oil and Cake Mills, Lim., Ord.	1 7/8 — 2
British Portland Cement Manufrs., Lim., Ord.	34/ — 36/
Brunner, Mond & Co., Lim., Ord.	1 15/16 — 2 1/16
Castner-Kellner Alkali Co., Lim.	2 5/8 — 2 7/8
China Clay Corporation, Lim., Ord.	1/4 — 3 8
Cook (Edward) & Co., Lim., 4% 1st Mort. Deb. Stock Red.	57 — 61
Courtaulds, Lim.	10 3/4 — 11 1/16
Crosfield (Joseph) & Sons, Lim., Cum. 6% Prefce.	
Curtis's & Harvey, Lim.	7/8 — 1 1/8
Explosives Trades, Lim., Ord.	2 9/16 — 2 13/16
Field (J. C. & J.), Lim., Ord.	22/ — 23/
Greenwich Inlaid Linoleum (Fredk Walton's New Patents) Co., Lim., Ord.	7/16 — 9/16
Harrison & Crosfield, Lim., 10% Cum. Prefd. Ord.	1/2 — 5/8
India Rubber, Gutta Percha and Tel. Wks. Co., Lim., Ord.	1 11/32 — 1 15/32
Lawes' Chemical Manure Co., Lim., Ord.	17½ — 18
Lever Bros., Lim., 6 % Cum. "A" Prefce.	6 — 6½
Do. 6½ % Cum. "B" Prefce.	20/1½ — 20/7½
Magadi Soda Co., Lim., Ord.	21/ — 21/6
Manganese Bronze and Brass Co., Lim., Ord.	1 3/32 — 1 7/32
Maypole Dairy Co., Lim., Defd. Ord.	¾ — ⅞
Mond Nickel Co., Lim., 7% Cum. Pref.	1 7/32 — 1 9/32
Do. 7% Non. Cum. Pref.	1½ — 1¾
Pacific Phosphate Co., Lim., Ord.	1 — 1 1/8
Power-Gas Corporation, Lim., Ord.	4 7/8 — 5 1/8
Price's Patent Candle Co., Lim.	¾ — ⅞
Salt Union, Lim., Ord.	39 — 41
United Alkali Co., Lim., Ord.	1¼ — 1⅜
Val de Travers Asphalte Paving Co., Lim.	1 5/16 — 1 9/16
Van den Berghs, Lim., Ord.	15/16 — 1 1/16
Walkers, Parker & Co., Lim.	3 9/16 — 3 13/16
Welsbach Light Co., Lim.	1 1/16 — 1 3/16
	2¾ — 3

Gas, Iron, Coal and Steel.

Gas Light and Coke Co., Ordinary Stock (4% Stand.)	57 — 59
South Metropolitan Gas Co., Ordinary (4% Stand.)	60 — 62
Ebbw Vale Steel, Iron & Coal Co., Lim., Ord.	29/ — 30/
Hadfield's, Limited, Ordinary	2 1/8 — 2 3/16
Staveley Coal & Iron Co., Lim., Ord.	1 13/16 — 1 15/16
Vickers, Limited, Ordinary	36/6 — 37/6

Mines, Nitrate, &c.

Rio Tinto Co., Lim., Ord. (Bearer)	58 — 60
Antofagasta Nitrate Co. Compañia de Salitres de Antofagasta) 5½% 1st. Mt. Debs. Red.	91 — 96
Lagunas Nitrate Co., Lim.	1⅜ — 1⅝
Tarapaca and Tocopilla Nitrate Co., Lim.	16/- — 17/-

Oil and Rubber.

Anglo-Persian Oil Co., Lim., Cum. 6 % Part.	
Mexican Eagle Oil Co., Lim. (Cia Mexicana de Pet. "El Aguila" S.A.) 8% Pref. (Bearer Non. Cum.)	1 5/16 — 1 3/8
"Shell" Transport and Trading Co., Lim., Ord.	7 3/8 — 7 1/2
Do. 5% Cum. Pref.	9 3/4 — 9 7/8
Anglo-Java Rubber & Produce Co., Lim.	9 — 9¼
Anglo-Malay Rubber Co., Lim.	6/10½ — 7/4½
Chersonese (F.M.S.) Estates, Lim.	13/1½ — 13/7½
Linggi Plantations, Lim., Ord.	3/10½ — 4/1½

Mr. George Keillor, engineer and manager of the Greenock Corporation Gas Department, suggests that the market price of liquor ammonia of about 0.910 specific gravity (say 25 per cent. strength), be included in our current prices. This will be done.

Production of Sulphuric Acid

Departmental Committee's Conclusions

THE Departmental Committee on the post-war position as to costs of production in the sulphuric acid and fertiliser trades have come to the following conclusions :—

(1) That for high strength acid, such as is employed in the dye industry, explosives manufacture, and in a few other small trades, the contact system is the cheapest and most efficient.

(2) That for low strength acid, such as is usually employed in the manufacture of fertilisers, there is little to choose between the Grillo contact system and the ordinary chamber plant as regards cost of production as SO_3, but other factors must be brought into reckoning, such as reduction of strength, storage facilities and factory room, which are to the advantage of the chamber system. We are disposed to think that when burning pyrites or zinc concentrates it would only be by the employment of highly trained and experienced staffs, such as would ensure the plant being operated continuously at a high standard of efficiency, that the Grillo plant could be succesfully run in competition with the chamber plant for low strength acids.

(3) That the cost of producing high strength or low strength acids by means of the Mannheim contact plant, whatever type of sulphur material is used, is substantially higher than in the case of the Grillo or Tentelew systems; that for low strength acids the Mannheim plant could not compete with the ordinary chamber plant.

(4) The cost of production cannot be dissociated from the question of the locality of the acid works, since ultimately it is the cost of acid delivered that counts; the close proximity of the acid works to the consuming factory is one of the most important factors in determining its ability to compete. We consider that this is a point of fundamental importance, and that the estimation of the relative efficiency of different factories in terms of the actual cost of production at these factories without having regard to their locality, is liable to be highly misleading. The real importance of the cost of any commodity is the cost to the consumer at the point of consumption and not at the producers' works. It is seldom possible for an acid works ill situated or built on too large a scale to be able to sell its acid within a comparatively small radius to make up by efficiency of working for the extra carriage involved in distributing the acid produced.

(5) That although the majority of manufacturing trades are dependent on supplies of sulphuric acid, in relatively few of these is the cost of acid an important factor, since the charge for acid in relation to the total cost of the manufactured goods is often very small or negligible. This applies to the whole group of engineering trades, to the textile trades, to leather, paint, and several smaller industries. In the case of the manufacture of artificial fertilisers the charge for acid is a relatively large proportion of the total cost of production, and in the manufacture of superphosphates, where competition is keen, the cost of acid is a factor of supreme importance. While, therefore, we consider that efficient working and low cost of production are essential throughout the industry, it becomes a manufacturing problem of even greater importance when associated with the production of superphosphate.

(6) That in spite of the fact that some acid works have in the past paid much attention to the question of costs, and have succeeded in producing acid at a low figure, there can be no doubt that the scientific study of costs has not been the uniform practice of the trade as a whole. This is a criticism applicable to other industries as well as the acid trade, but it is nevertheless impossible to state too strongly the need and importance, both in the interests of consumers as well as of producers, of a profound change in the methods of cost keeping, and of the application of strictly scientific methods to the study of costs in every operation of manufacture.

A system of cost keeping and of close study of costs has been developed in great detail at the Government factories. Very extensive records from month to month have been kept, not only in connection with the acid plants but with each operation in the manufacture of explosives.

We recommend that after the war the information thus collected should as far as possible be placed at the disposal of private manufacturers, not only on account of its intrinsic value, but as an illustration of a method of work which is only too little followed in this country.

Notices.

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ADVERTISERS on the North East Coast wish to be put in communication with firms who are in the position to undertake the tin plating of large vessels. Address, stating full particulars, to Box No. 1, CHEMICAL AGE Offices, 8, Bouverie St., E.C. 4.

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SOFT SOAP MAKERS invite correspondence with buyers for home and export, all grades.—J. R. Peace & Company, 6, Rumford Place, Liverpool. Established 1867.

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